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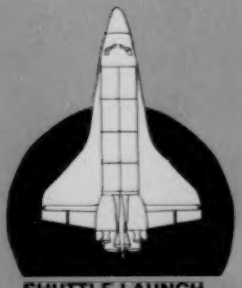

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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13 ASTRODYNAMICS 2958
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For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS N.A.
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 3075
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 3075
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3078
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 3079
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3080
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3080
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 3081
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3082
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 3082

Note: N.A. means that no abstracts were assigned to this category for this issue.

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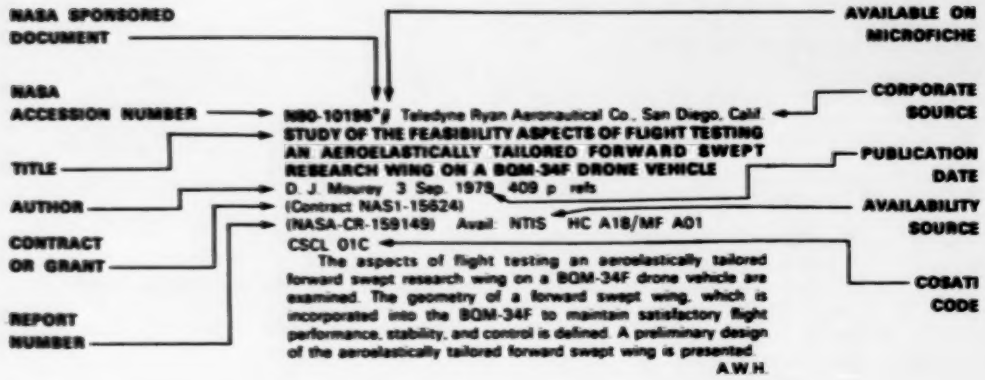
TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, STANFORD/AMES JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS - STUDIES OF TURBULENT SEPARATION OF AIRFOILS AND WINGS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, STUDY FOR THE EVALUATION OF IN-FLIGHT INSTRUMENT FLIGHT RULES PROCEDURES TRAINER
J.H. Gandelman, Embry Riddle Aeronautical University, Graduate School, *Regional Airport, Daytona Beach, Florida* 32014 (NAS 6-3040)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

1.0003, DATA ANALYSIS FOR PLASMA WAVE INSTRUMENT DYNAMICS EXPLORER PHASE III
S.D. Shawhan, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-25690)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0004, GRADUATE STUDENT RESEARCHERS PROGRAM
A.F. Davidsen, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NGT 21-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0005, BASIC RESEARCH IN DIGITAL STOCHASTIC MODEL ALGORITHMIC CONTROL
R.K. Mehra, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DF143940; F33615-79-C-3613)

This effort supports AFFDL TP03, flight control technology, and specific goal FG02, flight control system design techniques. Most current digital design methodology used in practice is in reality a conversion of a predesigned analog system, using various approximate transformations. These procedures do not take into account the inherent flexibility and uniqueness of the digital computer to solve control of flight problems. The specific objective of this research is to create the mathematical basis that may be utilized by practicing control system engineer to directly design a robust and hierarchical digital control system for a flight vehicle characterized as multiple input/output and whose dynamics are characterized by equations of motion that are piecewise-continuous and nonstationary. In addition, the mathematics must account for state and control constraints and allow for a mixed analog/digital controller design. The payoff of such research is dramatic in that robustness permits some uncertainty in the dynamics of the unaugmented flight vehicle, hierarchy transitions analog frequency design procedures to direct digital control design and, finally, the capability to mix analog and digital controllers helps to minimize the risk of transition of the control system designs from totally analog to direct digital. This latter payoff will be particularly beneficial for advanced control configured vehicle control system designs currently envisioned, as they have been flight test proven primarily by analog mechanization. A satisfactory conclusion of the research will lead to a cost and performance optimized digital control system for future military aircraft.

The first task in the research effort is to critically evaluate current implementations of the MAC concept to identify those algorithm parameters that are sensitive to process and measurement noise, and those parameters that determine stability, sample rate selection, and robustness of the digital controller. This first task will be largely analytical. The second task of the research effort is to demonstrate the analytical conclusions and design guidelines using a digital simulation of a generic tactical missile-autopilot combination. The final product for this research shall be an explicit description of the criteria necessary to achieve the stated digital control design objective using the model algorithmic control (MAC) concept. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, NACS EXPERIMENT FOR DYNAMICS EXPLORER PROJECT PHASE III
G.R. Carignan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (NAS 5-26069)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0007, DATA ANALYSIS FOR FABRY-PEROT-INTERFEROMETER FOR DYNAMICS EXPLORER PROJECT PHASE III
P.B. Hays, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (NAS 5-25691)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0008, DEVELOPMENT OF AN AERODYNAMIC HEATING COMPUTER PROGRAM FOR COMPUTER-AIDED DESIGN SYSTEMS
F.R. Dejarnette, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Raleigh, North Carolina* 27607 (NCC 1-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0009, A DIGITAL CONTROL VALVE INVESTIGATION
G.D. Jenney, Dynamic Controls Inc., *Dayton, Ohio* (DF143560; F33615-79-C-3605)

This effort addresses flight control actuation technology for military aircraft. Conventional analog electrohydraulic control valves contain a spool valve which moves in proportion to the amplitude of the input signal. The spool valve is sensitive to hydraulic fluid particle contamination and has a leakage path between the spool and its sleeve. reducing this leakage path by reducing the clearance between the spool and sleeve increases contamination sensitivity and the possibility of galling due to spool and sleeve thermal and structural distortions. The objective of this effort is to establish the feasibility of using a digital (solenoid) control valve in place of the conventional analog electrohydraulic control valve for aircraft control systems. This will significantly simplify the mechanical control actuator design and improve reliability.

A digital control valve will be mechanized with solenoid operated two position poppet valves which exhibit both positive seal off and contamination insensitivity. The control valve will be assembled in an actuator assembly with driving electronics and the assembly tested. The investigation will also concentrate on developing a suitable solenoid valve specifically for the digital valve application.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0010, COMPUTATIONAL METHODS FOR LARGE AEROSPACE STRUCTURES
V. Venkayya, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143120)

The Air Force function that this work effort supports is basic research in structural mechanics for aerospace vehicles. The deficiency is in computational models for large aerospace structures which incorporate static, dynamic and thermal loading. The objective is to assess our computational capability to work such problems, develop more efficient methods, and improve our understanding of the exo-atmospheric loading environment. This work will contribute to improving the design of low-cost, lightweight, large aerospace vehicles.

Initial activities will concentrate on an assessment of current local computational methods for problems involving discrete structures under static, dynamic, and thermal loading. Methods will be improved as necessary using numerical algorithms and modelling techniques currently being developed. Large lattice type structures will be examined to improve methods for systems with many degrees of freedom.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, SYSTEM DESIGN OF A 20 KW PHOTOVOLTAIC CONCENTRATOR APPLICATION EXPERIMENT AT THE DALLAS-FORT WORTH, TEXAS AIRPORT
Unknown, E Systems Inc., *1200 S. Jupiter Rd., P.O. Box 226118, Dallas, Texas* 75266 (ET-78-C-04-5311)

SUPPORTED BY U.S. Dept. of Energy

1.0012, DEVELOPMENT OF A UNIFIED THERMAL AND TRAJECTORY MODEL FOR THE PREDICTION OF HIGH-ALTITUDE BALLOON PERFORMANCE
L.A. Carlson, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 6-3072)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

1.0013, ION DRIFT METER INSTRUMENT DATA ANALYSIS FOR DYNAMICS EXPLORER
R.A. Heelis, University of Texas, Dallas Campus, Graduate School, *Richardson, Texas* 75080 (NAS 5-26068)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0014, LOW ATTITUDE PLASMA INVESTIGATION DATA ANALYSIS FOR DYNAMICS EXPLORER PHASE III
J.D. Winningham, University of Texas, Dallas Campus, Graduate School, *Richardson, Texas* 75080 (NAS 5-26070)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0015, RETARDING POTENTIAL ANALYZER INSTRUMENT FOR DYNAMICS EXPLORER PHASE III
W.B. Hanson, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (NAS 5-26071)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, COMPUTING LOW-THRUST TRANSFERS TO SYNCHRONOUS ORBIT
J.V. Breakwell, Stanford University, School of Engineering, Dept. of Aeronautics, *Stanford, California* 94305 (NAG 3-63)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

2.0002, NUCLEAR POWERED SATELLITE STUDIES
Unknown, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (EY-76-S-02-4045)

SUPPORTED BY U.S. Dept. of Energy

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CONVERSION OF CELLULOSIC AND WASTE POLYMER MATERIAL TO GASOLINE
J.L. Kuester, Arizona State University, School of Engineering & Applied Sciences, Dept. of Chemical Engineering, *Tempe, Arizona* 85281 (EY-76-S-02-2982)

The project is aimed at the conversion of cellulosic or waste polymer materials to liquid, transportable fuels. The cellulose source may be from urban refuse, agricultural or forest residues or from crops deliberately grown for energy conversion purposes (land or marine). Since cellulose (biomass) is obtained by photosynthesis (carbon dioxide plus water plus sunlight), the project is solar in nature and the feedstock (plant material) is considered a renewable resource. The process involves decomposing the feed material to basic compounds under the influence of heat (pyrolysis). The basic compounds are then introduced into a chemical reactor where a diesel or jet fuel type material is produced. If a high octane gasoline is desired, a final reaction step is used (reforming).

SUPPORTED BY U.S. Dept. of Energy

3.0002, A STUDY OF PROCESSING PARAMETERS FOR NON-METALLIC COMPOSITES
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0003, PHOTOCHEMISTRY OF MATERIALS IN THE STRATOSPHERE, LAWRENCE BERKELEY LABORATORY
H.S. Johnston, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (ERDA EC 04-01-01)

(1) A small telescope, spectrometer, optical multichannel analyzer, and minicomputer are used to follow light directly from the sun and from Rayleigh-scattered zenith sky light during sunrise or sunset. (2) Laboratory studies are made of elementary chemical and photochemical reactions for which rate constants are needed for model calculations in the atmosphere, and such model calculations are made. (1) By the end of calendar 1976, we hope to have established the feasibility (or not) of the method being used. (2) The results expected are new rate constants for reactions involving HO, HOO, Cl, ClO, and NO/ sub 3/ free radicals and for molecular N/sub 2/O/sub 5/. (1) If the method is feasible, the apparatus will be simplified to a maximum possible extent, and another simpler system will be built. (2) Each new or better rate constant is a goal in itself, and it can be entered in tables of such values used by modelers of atmospheric reactions or of other processes involving the same reactions.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

3.0004, CROSSED MOLECULAR BEAMS
Y.T. Lee, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

Investigation of the dynamics of elementary atomic and molecular processes and the energetics of exotic radicals and ion clusters using crossed molecular beams. Information on mechanism and dynamics of chemical reactions obtained from the direct identification and measurements of velocity and angular distributions of product molecules from single collisions. Reactions of oxygen atoms and free radicals with carbon-containing molecules and radicals under single collision conditions; primary products of many important reactions of oxygen atoms; hyperthermal chemical reactions of hydrogen, deuterium and halogen atoms; reaction of electronically excited atoms and molecules; interaction potentials between atomic and molecular species; inter- and intramolecular energy transfers and the energetics of radical molecules and the spectroscopy of molecule ions. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0005, RESEARCH IN CHEMICAL KINETICS
F.S. Rowland, University of California, Irvine Campus, School of Physical Sciences, Dept. of Chemistry, *Irvine, California* 92664

(1) Laboratory measurement of the cross-sections for absorption of solar ultraviolet and visible radiation by molecules of stratospheric interest, including CCl/sub 2/F/sub 2/, CCl/ sub 3/F, CClFO, ClONO/sub 2/, etc. (2) Laboratory measurement of chemical reaction rates pertinent to stratospheric chlorine chemistry. (3) Computer calculations of atmospheric profiles for various chemical compounds, including CCl/sub 2/F/ sub 2/, CCl/sub 3/F, CClFO, etc. (4) Consideration of the physicochemical processes for removal of halogen-containing molecules from all parts of the atmosphere. (1) Completion of above tasks. (2) Formulation of new problems in response to results and/or interpretations of experiments described above. The results should aid in control decisions on the possible ban of certain chlorofluorocarbon compounds (and exclusion of others) because of the hazard of stratospheric ozone depletion. (1) No scheduled decision dates. (2) No dates scheduled for completion of particular instruments, or for particular research tasks among those listed above. (3) Next scheduled project report: September, 1977. (4) Reports on completed phases of the scientific work as each phase reaches a suitable stage of completion.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

3.0006, AN INVESTIGATION OF THE EFFECT OF SURFACE IMPURITIES ON THE ABSORPTION KINETICS OF HYDROGEN CHEMISORBED IRON
M.R. Shanabarger, University of California, Santa Barbara Campus, School of Engineering, Dept. of Chemical & Nuclear Engineering, *Santa Barbara, California* 93106 (NCC 2-63)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0007, ELECTRODE POLARIZATION STUDIES IN HOT CORROSION SYSTEMS
O.F. Devereux, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (EY-76-J-02-2960)

Hot corrosion of structural metals, iron, chromium, nickel, steel, and stainless steel, will be studied via electrode polarization in electrolytes which may arise in coal gasification reactors, specifically, molten sodium carbonate equilibrated with various sulfur-bearing reducing gas mixtures. Gas chemistry will be controlled by control of P/sub H2/, P/sub CO/, and P/sub H2S/, with a total pressure of one atmosphere and a temperature of 1000 degrees C. The nature and activity of other gas and liquid-phase species will be determined by thermodynamic modelling. Parallel manometric studies will be conducted on the nature of the gas/metal reaction in the absence of an electrolyte. These studies are intended to yield both empirical design data and detailed information concerning the nature of the hot corrosion reactions in these systems, and thermodynamic and kinetic parameters pertaining thereto.

SUPPORTED BY U.S. Dept. of Energy

3.0008, RESEARCH PROGRAM IN MATERIALS SCIENCE
H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0009, INVESTIGATIONS OF INTERMETALLIC ALLOY HYDRIDING MECHANISMS
B.R. Livesay, Georgia Inst. of Technology, Georgia Tech Research Inst., *225 North Ave. N.W., Atlanta, Georgia* 30332 (EY-76-S-05-5246)

The objective of this program is to characterize the microstructure and physical properties of selected intermetallic compounds as related to the hydrogen sorption and desorption processes The investigations primarily concern films (both thin and thick) of FeTi and certain RT5 alloy systems where R repesents a rare earth and T a transition metal element. Through hydrogen absorption, these alloys present significant energy storage possibilities. Changes in the microstructure, magnetic properties, electronic structure, and pressure-composition relationships caused by modifications to the alloy system are studied. Surface coatings, ternary element substitutions and thermal-mechanical treatments are among the modifications made to provide information which will lead to fir.ling an optmal alloy system for hydrogen storage. The hydrogen-alloy system properties are characterized using such anal'ytical techniques as TEM, AES and SEM as well as resistivity and magnetic measurements. The high critical hydrogen-alloy compositional curves are determined using microbalance techniques. Film thicknesses are also adjusted to provide a separation between bulk and surface properties. Attention is directed towards establishing factors that determine such chracteristics as hydride nucleation sites, growth

mechanisms, hydride decomposition, hysteresis and stability, which govern the hydriding behavior of these systems.

RESULTS: Developed methods for preparation and study of hydriding intermetallic compounds in form of thin films which remain intact during hydride cycling. Measured behavior of magnetization and magnetic anisotropy energies as function of equilibrium hydrogen pressure. Developed high hydrogen pressure equipment systems for in situ physical property measurements: 1a. Torque magnetometer; 2a. Tricrobalance; and 3a. Four-point-probe resistivity cell.

SUPPORTED BY U.S. Dept. of Energy

3.0010, HYDROGEN BEHAVIOR IN BCC METALS

H.K. Birnbaum, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering/Materials Research, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The mobility of hydrogen and its isotopes in solids is being studied using a variety of techniques. Emphasis is being placed on understanding the quantum diffusion mechanism of these light interstitials. Long range diffusion measurements using the Gorsky effect and local reorientation studies of H and its clusters with other solutes using acoustic techniques are being carried out. In addition to measurements of the H jump frequencies over a wide temperature range, these techniques allow a determination of the non-classical isotope effects and of the structure and behavior of small solute clusters containing H. A new technique, anelastic piezo-resistance is being applied to these studies.

In addition to its behavior inside the metal, the mobility of hydrogen at the metal-gas surface is being studied using the combined techniques of Raman spectroscopy, Auger analysis and permeation methods. This study determines the vibrational modes of H, its interactions with absorbed surface species such as SO2, H2S and H2O, and the effect of these factors on entry of hydrogen into the solid.

In cooperation with Argonne National Laboratory we are using electron diffraction, T.E.M. and neutron scattering methods to study the behavior of hydrogen in high concentration alloys. Phonon dispersion curves, diffuse scattering and crystal structure determinations are all being applied in an attempt to understand the dramatic changes in physical properties on forming the high H concentration alloys.

SUPPORTED BY U.S. Dept. of Energy

3.0011, APPLICATIONS OF ELECTRON MICROSCOPY IN MATERIALS SCIENCE

H.L. Fraser, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering/Materials Research, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

This project is divided into three subgroups; one involves the development of techniques and interpretative methods of analytical electron microscopy. In this area, much work has been done on the use of x-ray energy dispersive analysis for microchemical determination in thin foils on the scale of approximately 200 Angstrom units. The sources of spurious x-ray signals have been determined and methods to reduce their contribution to the measured x-ray spectrum have been accomplished. Electron energy loss spectroscopy for light element determination has also been developed. The other two parts of this project involve a study of plasmon losses evident in the electron energy spectrum in specimens of various hydrogen metal alloys, and the effect of surface oxidation on defect production in B2 compounds (specifically Beta-NiAl). In the study of plasmon losses, the aim is to develop a technique of identifying and possibly quantifying hydrogen hydrides in thin metal foils. In the case of surface oxidation, it is important to understand the source of defects that are generated during annealing.

SUPPORTED BY U.S. Dept. of Energy

3.0012, MECHANISM OF STRESS-CORROSION CRACKING PROPAGATION STUDIES

E.N. Pugh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-02-1198)

The propagation of stress-corrosion cracks is being investigated in a range of engineering materials, primarily using fractographic and acoustic-emission techniques. In 1978, the studies were focussed on two alloys, namely Ti-8Al-1Mo-1V and Admiralty Metal. In the former, a comparison was completed of the characteristics of stress-corrosion cracking (SCC) in aqueous chloride solutions, internal hydrogen embrittlement (IHE) and gaseous hydrogen embrittlement (GHE). The comparison provided strong evidence that SCC in Ti-8Al-1Mo-1V is a form of hydrogen embrittlement. A layer of titanium hydride was observed on fracture surfaces produced by GHE, supporting the view that cracking proceeds discontinuously by the repeated formation and rupture of this brittle layer. Crack propagation was also discontinuous in SCC and IHE, but there was no evidence for hydride formation, leaving the specific role of hydrogen in doubt in these cases. In the case of Admiralty Metal, SCC in ammoniacal solutions was found to occur by discontinuous cleavage on (110) planes. The cause of embrittlement has not been established in this case but both hydrogen and selective dissolution of zinc are currently being investigated.

SUPPORTED BY U.S. Dept. of Energy

3.0013, THE APPLICATION OF X-RAY PHOTOELECTRON AND AUGER SPECTROSCOPY TO SOME SELECTED GEOCHEMICAL PROBLEMS

I. Adler, University of Maryland, College Park Campus, School of Agriculture, Dept. of Chemistry, *College Park, Maryland* 20742 (EAR78-16421)

This project is concerned with the use of X-ray photoelectron and Auger Spectroscopy for research in several diverse areas including electronic structures of minerals, interaction processes between small organic molecules with clay and mineral surfaces, radiation damage in mineral systems such as those associated with solar wind bombardment of lunar surfaces and finally the Auger Spectra of the transition metals. Some of the proposed studies include the study of ion induced chemical alterations by XPS, the electronic structure and spectra of sulfide minerals, the electronic structure of silicates and studies on the interactions of small organic molecules with clay mineral surfaces.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

3.0014, SOURCES AND DISTRIBUTION OF TRACE ELEMENTS IN THE ANTARCTIC ATMOSPHERE

W.H. Zoller, University of Maryland, College Park Campus, School of Agriculture, Dept. of Chemistry, *College Park, Maryland* 20742 (DPP79-08964)

Gaseous and particulate samples from the Antarctic atmosphere that were collected over the past austral winter and summer at South Pole and aboard an instrumented LC-130 aircraft during the past austral summer will be analyzed. The chemical composition of these aerosols will be determined. Their variation as a function of particle size and time will be investigated, and these parameters will be related to the history of the air masses that were sampled. The size distribution of the particulate material will also be determined, and the effect of ice crystals scavenging for the removal of the particulate material from the atmosphere will be investigated. The samples taken of the Mt. Erebus plume will be evaluated to determine if Erebus emissions are a source of the aerosols observed at South Pole.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

3.0015, THE STUDY OF ATPASES IN EXTREME HALOPHILES AS FOSSIBLE EVOLUTIONARY MARKERS
C.A. Ponnamperuma, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Chemistry, *College Park, Maryland* 20742 (NCA 2-420001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0016, METAL VAPOR EXCIMERS
J. Jacob, Avco Corp., Everett Research Laboratory, *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149 (ES-77-C-02-4275)

The objective of this research is to investigate metal vapor excimers and CdHg in particular. To achieve this objective, a 600 degrees C discharge cell will be designed and fabricated. This cell will be interfaced with a high energy electron gun. Initially the discharge physics will be studied; we will obtain V-I characteristics. The fluorescence efficiency of CdHg will be measured. Also, by probing the active medium with a dye laser we will measure the gain and absorption as a function of wavelength. Finally, an optical cavity will be constructed and laser experiments on the CdHg will be attempted.

SUPPORTED BY U.S. Dept. of Energy

3.0017, MATERIALS PROCESSING RESEARCH BASE FOR THE MATERIALS PROCESSING
M.C. Flemings, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7645)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

3.0018, ELECTRONIC CONDUCTION IN SOLID OXIDE ELECTROLYTES
H.L. Tuller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EG-77-S-02-4436)

The following investigations are being performed: electronic conduction in solid oxide electrolytes, a subgroup of fast ionic conductors in which oxygen diffuses rapidly at elevated temperatures. Parameters controlling nonstoichiometry, impurities, and electronic mobility; pure and doped ThO2 examined for electronic conductivity, thermoelectric power, and ionic transference number; and microstructural studies of second phases, grain boundary effects, and segregation. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0019, SPECTROSCOPIC INVESTIGATIONS OF SMALL MOLECULE INTERACTIONS ON METAL OXIDE SURFACES
E.I. Solomon, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ER-78-S-02-4988)

A research program for the investigation of the surface chemistry of catalytically important metal oxide systems is proposed. Primary emphasis will be placed on the interaction of a number of chemically relevant small molecules with zinc oxide, aluminum oxide and chromium oxide single crystal surfaces and catalytic powders. These experiments will employ two separate vacuum systems, in order to perform both survey type and detailed spectroscopic investigations. The surveys of the adsorption chemistry of these crystals will be performed using angle integrated ultraviolet photoemission spectroscopy in combination with Low Energy Electron Diffraction, Auger, and X-ray photoemission spectroscopy. More detailed spectroscopic investigations of the adsorbed molecules will be performed using angle-resolved ultraviolet photoemission and high resolution electron energy loss spectroscopy. By these techniques we hope to elucidate the nature of the surface geometric and electronic structural requirements for chemisorption on these materials, and thus gain insight into the fundamental processes of oxide catalysis.

RESULTS TO DATE: Studies have been performed on single crystal surfaces of zinc oxide for four orientations: (1010), (1120), (0001), and (0001). Adsorption of CO is strongly enhanced on the two non-polar (1010) and (1120) faces over the adsorption on the polar (0001) and (0001) faces, indicating that the adsorption requires both coordinatively unsaturated zinc and oxygen ions. (Adsorption on the polar faces would then be associated with the high density of non-polar steps occurring on these faces.) Further chemisorption studies have been performed with NH3, H2O, CO2, H2 and 02. Poisoning and ligand competition studies on the four ZnO faces have been used to investigate the adsorption behavior and to further characterize the nature of the interaction of CO with ZnO.

SUPPORTED BY U.S. Dept. of Energy

3.0020, ALTERNATIVE FUELS/ENERGY SOURCE STUDY FOR NONHIGHWAY TRANSPORT SYSTEMS
R. Alpaugh, Exxon Research & Engineering Co., *1600 Linden Ave., Linden, New Jersey* 07036 (EC-77-C-05-5438)

In this project combinations of power systems, fuels, and time frames will be evaluated for the purpose of identifying the most attractive of these combinations for further development and commercialization. To accomplish this a literature search will be conducted. The data will be screened by considering issues such as resource availability, interaction with military and international sectors, institutional problems, and cross-mode impacts. A ranking of fuel choices by mode and time frame will then be developed. From this, R and D requirements will be identified and the contractor will recommend an R and D program designed to promote the orderly transition of nonhighway modes to non-petroleum based fuels.

SUPPORTED BY U.S. Dept. of Energy

3.0021, DEUTERIUM PLASMA-MATERIAL WALL INTERACTIONS
J.K. Tien, Columbia University, School of Engineering & Applied Science, Dept. of Mining Metallurgical & Mineral Engineering, *Broadway & W. 116th St., New York, New York* 10027 (EG-77-S-02-4393)

The achievement of fusion as a safe, viable energy source depends on the integrity of the materials used to contain the thermonuclear reaction. Of all the fluxes which these materials will have to withstand, one of the most insidious involves the interaction of the fuel for the fusion reaction, that is, the hydrogen isotope plasma with material surfaces. Hydrogen isotopes are capable of reducing the ductility of structural materials to unacceptable levels. In addition, their bombardment of material surfaces results in significant loss of material leading to poisoning of the plasma and thus to preventing the achievement of fusion conditions. At Columbia University, we employ an electromagnetic plasma shock tube to study the accelerated exposure of materials to deuterium plasma. A single shock tube run, lasting only 20 hours, is the equivalent of an entire year of Tokamak fusion power reactor, deuterium plasma exposure. A range of materials is being subjected to plasma exposure. They include candidate fusion materials, such as stainless steels, and nickel base alloys; advanced concept materials such as refractory metal alloys; and nonmetallics such as graphite and boron nitride. We have documented the occurrence of unipolar arcing, a most insidious mechanism which is capable of producing copious amounts of plasma impurities. We have also determined by direct observation the penetration of deuterium into these materials. The occurrence of bulk embrittlement effects has also been detected. Our next objective is to extend our work to include the plasma exposure of specimens at elevated temperatures, typical of actual reactor operation (i.e., approximately 500 degrees C).

SUPPORTED BY U.S. Dept. of Energy

3.0022, NITRIC OXIDE PRODUCTION FROM CHEMICALLY BOUND NITROGEN IN COAL
Unknown, Research Foundation of State University of New York, *P.O. Box 9, Albany, New York* 12201 (EF-77-G-01-2742)

The factors which influence the conversion of chemically bound nitrogen in coal to the oxides of nitrogen will be exam-

ined in a laboratory combustor. The work will focus on the role of flame temperature, coal and char composition and aerodynamic mixing on fuel nitrogen conversion in coal combustion. The problem will be approached experimentally in two steps. First the relative levels of fuel NO and thermal NO will be determined for a pulverized coal diffusion flame. Fuel NO will be isolated by using various mixtures of argon, oxygen and carbon dioxide in place of atmospheric air in our combustor and comparing to the NO levels obtained when the coal sample is burned in air under that same flame temperature condition. Different types and ranks of coal will be examined to determine the influence of the actual fuel composition upon our results. The composition will be determined from ultimate and proximate analysis. The composition of the products of combustion will be sampled and analyzed using a variety of techniques. The NO, NO2, CO2,O2, SO2 and total hydrocarbon gas concentrations will be monitored in the exit plane of the combustor. This will provide an overall evaluation of factor influencing NO production from fuel bound nitrogen compounds. The second phase of the work will examine the influence of coal particle density and velocity (hence mixing effects) upon NO generation. Sampling will also be done at these locations to provide a concentration map of constituents within the combustor. Results should provide insight of the local effects influencing fuel NO production.

SUPPORTED BY U.S. Dept. of Energy

3.0023, THEORETICAL STUDIES OF CHEMISORPTION ON TRANSITION METAL SURFACES - INTERACTION OF HYDROGEN WITH TITANIUM
J.L. Whitten, Research Foundation of State University of New York, *Stony Brook, New York* 11794 (EG-77-S-02-4387)

This research is concerned with the theory of chemisorption of molecules on solid surfaces and is directed toward the development of a theoretical model for treating electronic interactions ab initio. Calculations on the hydrogen - titanium system are proposed in which the objective is to obtain a detailed account of molecule - surface interactions including an adequate response of the lattice to the adsorbate. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy

3.0024, LOCAL ELECTRONIC PROPERTIES OF SEMICONDUCTOR SURFACES AND INTERFACES
M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (EG-77-S-02-4435)

The local electronic properties of surfaces and interfaces of some elemental and compound semiconductors will be studied using Auger Electron Spectroscopy (AES). In addition, chemisorption of Cl and O on Si will be studied. AES will be augmented with XPS and UPS to investigate a series of orthorhombic IV--VI semiconductor compounds. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MODELING OF THE EVOLUTION OF MAGNETIC FIELD STRUCTURE IN AN ACTIVE REGION
S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NGT 01-002-081)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, CONCEPTUAL DESIGN STUDY OF LIGHTNING OPTICAL/SENSOR SYSTEMS
W.L. Wolfe, University of Arizona, Graduate School, Dept. of Optical Sciences, *Tucson, Arizona* 85721 (NAS 8-33720)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0003, LIGHTNING DETECTION FROM SPACE
P. Krider, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Sciences, *Tucson, Arizona* 85721 (NAS 8-33718)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0004, FAILURE MECHANISM STUDY OF GAAS TECHNOLOGY
G. Ladd, Hughes Aircraft Co., *3100 W. Lomita Blvd., Torrance, California* 90509 (DF912000; F30602-78-C-0326)

The objective of this effort will be to determine the reliability limitations of GaAs field effect transistor devices.

The approach will consist of in-depth physical studies of possible life limiting mechanisms such as electromigration, ohmic contact degradation, charge trapping at interface, crystal defects, deplating of metals, and defects in passivation. Arrhenius activation energies for the above mechanisms will be determined and their effect on the reliable life of various FET devices will be developed. Devices representing the limits of frequency, power output, and low noise will be analyzed to establish worst case operating conditions with trade-offs depending on the system life required for various applications. Test structures will be used to isolate various failure mechanisms for detailed determination of the activation energy and the affect of material, processing and stress factors on the activation energy. The end item will be a report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0005, DESIGN AND CONSTRUCT PROTOTYPE ENGINE FOR ENERGY CONSERVATION - 1HP NITINOL HEAT ENGINE
Unknown, McDonnell Douglas Corp., *5301 Bolsa Ave., Huntington Beach, California* 92647 (ET-78-C-05-6028)

SUPPORTED BY U.S. Dept. of Energy

4.0006, LABORATORY TEST OF THE THEORY OF IONOSPHERIC STABILITY UNDER POWER SATELLITES
Unknown, Power Conversion Tech. Inc., *San Diego, California* 92121

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

4.0007, THE FOURTH INTERNATIONAL CONFERENCE ON PHOTON CORRELATION TECHNIQUES IN FLUID MECHANICS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0008, CONTROL AND MODELING OF A CELSS (CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM)
D.M. Auslander, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (NCC 2-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0009, VAPOR-LIQUID PHASE SEPARATOR
T.H. Frederking, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (NCC 2-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0010, HIGH DEFORMATION-RATE EXTENSIONAL RHEOLOGY OF POLYMERIC ANTI-MISTING ADDITIVES
S. Middleman, University of California, San Diego Campus, School of Engineering, Dept. of Aerospace & Mechanical Engineering Sciences, *P.O. Box 109, La Jolla, California* 92037 (NCA 2-658001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0011, ASSESS USE AND DEVELOPMENT OF A COMPUTER CODE ROTATING FLOWS
K.J. Kopecky, Drake University, School of Liberal Arts, Dept. of Mathematics, *25th & University Ave., Des Moines, Iowa* 50311 (NAS 8-33728)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0012, RECRUIT INTO ENGINEERING HIGH ABILITY MINORITY AND FEMALE STUDENTS (REHAMFS)
J.W. Bonds, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NCA 5-96)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0013, REDUCTION OF RTG DATA FROM VIKING LANDERS AND PIONEER SPACECRAFT
C. Goebel, Teledyne Energy Systems, *110 W. Timonium Rd., Timonium, Maryland* 21093

SUPPORTED BY U.S. Dept. of Energy

4.0014, NONLINEAR OPTICAL INTERACTIONS IN SEMICONDUCTORS
M.M. Salour, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF055150; F49620-79-C-0071)

AF function - secure space communications and covert optical electronics require devices which exploit special properties and interactions of materials with infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this effort investigates a variety of nonlinear optical processes in semiconductors utilizing ultrafast spectroscopic techniques to probe the basic physics of the interaction of intense subpicosecond pulses with semiconductors. How work contributes - the ultimate goal of this work is to use these interactions as the basis for obtaining tunable coherent infrared sources as required for communications, optical radars, and plasma diagnostics for plumes and exhausts.

To achieve the goal of generating tunable coherent infrared sources and controlling this radiation by means of novel mode-locking and modulation techniques, the following nonlinear processes will be studied: 1) ultrafast radiative recombination processes in CDS and CDSE - the characteristic delay, rise and decay times of recombination radiation at high exciton densities will be measured, 2) enhancement of electron-hole recombinations by adjusting the band gap of narrow-gap semiconductors to the energy of elementary excitation in solids such as phonons or plasmons. Testing this approach via pumping of different samples of n-type semimetallic Hg1-x Cd x Te and making time resolved photoconductivity and lifetime measurements with an ultrafast streak camera, 3) pulsed, optical pumping experiments in semiconductors, 4) time resolved induced absorption due to exciton-biexciton transitions, 5) laser-induced dielectric breakdown in transparent solids, 6) optical frequency mixing spectroscopy in semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, DYNAMIC ANALYSIS OF THE SOLAR ELECTRIC PROPULSION (SEP) SOLAR ARRAY AND SPACE SHUTTLE
E.G. Abu Saba, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Civil Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NCC 1-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0016, MICROPROCESSOR CONTROL OF A WIND TURBINE
A. Dybbs, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NCC 3-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, POWER TRAIN DEVELOPMENT/ANALYSIS LARGE SCALE WIND TURBINE SUPPORTING RESEARCH AND TECHNOLOGY PROGRAM
R. Kasuba, Cleveland State University, School of Engineering, Dept. of Mechanical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NCC 3-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0018, APPLIED AERODYNAMICS OF WIND TURBINES
R.E. Wilson, Oregon State Higher Education System, Oregon State University, School of Engineering, Dept. of Mechanical Engineering, *200 Covell Hall, Corvallis, Oregon* 97331 (EY-76-S-06-2227-023)

SUPPORTED BY U.S. Dept. of Energy

4.0019, RAY-TRACING FOR EFFECTS OF DISTURBANCES & SPACETENNA STRUCTURAL DISTORTIONS ON THE SOLAR POWER SATELLITE PILOT BEAM SIGNAL (ABBREV)
A. Marouf, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 9-16088)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0020, TIRE NONLINEAR MODEL
C.M. Anderson, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NCC 1-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0021, ELECTRON BEAM CHARGING AND ARC DISCHARGING OF SPACECRAFT INSULATING MATERIALS
K.G. Balmain, University of Toronto, *92 College St., Toronto, Ontario, Canada* M5S 1B2 (NSG 7647)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, LNB SYSTEMS DEVELOPMENT

R.H. Canada, Sperry Support Services, *1112 Church St., Huntsville, Alabama* 35801 (NAS13-60)

OBJECTIVE: To develop a meteorological and oceanographic data acquisition system for installation on the U.S. Coast Guard's Large Navigation Buoys (LNB). The data will be transmitted via the GOES satellite and distributed via the National Weather Service's network.

APPROACH: A prototype system was installed in October 1979 on the Columbia River Bar LNB for a six-month test and evaluation. Results of the prototype testing will be used to finalize the design for refitting most of the LNB's.

CURRENT PLANS AND PROGRESS: The procurement and installation of operational systems will begin in FY81 as part of the National Weather Service's Coastal and Offshore Observation Programs (COOPS).

SUPPORTED BY U.S. Dept. of Commerce, Office of Ocean Engineering, National Data Buoy Office

5.0002, FIELD SUPPORT FOR STATE PLUME STUDIES

J.F. Meagher, U.S. Tennessee Valley Authority, Air Quality Research Section, *c/o OSWHA, Muscle Shoals, Alabama* 35660 (D8-E721-DL; G603A-AA-053)

This task is part of a large program to determine transport, transformation, and removal processes and rates affecting atmospheric concentrations of sulfur compounds. Initial emphasis is on studies of definable plumes out to times and distances of 24 hrs. and 500 km, respectively. Field support consists of providing personnel to make observations, collect data, perform limited source sampling, and support other investigators, as well as providing physical facilities, including power and communications for the many components of the study. Support aircraft are also provided.

The output of this task is principally support for all investigators in the program; limited analyses of data on source emissions rates and boundary layer structure will also be furnished.

Work underway in preparation for the study will be continued through the actual field work in August 1978.

Copies of data for deriving emission rates from the TVA's Cumberland power plant for all days of the August field study were furnished, together with data for the Johnsonville and Paradise plants when plumes from these sources might have been affecting sampling results. Copies of five unpublished data volumes listing meteorological and air quality monitoring data were prepared and distributed to participants for use in analyzing data from surface and airborne measurement platforms. Copies of the data on magnetic tape were provided to the STATE data bank. A two-volume analysis of the meteorological conditions for each sampling day was prepared and distributed to participants.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0003, STUDY EFFECTS OF INTERNAL WAVE ON THE NEUTRAL ATMOSPHERE

R.J. Hung, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAS 8-33726)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0004, ANALYSIS AND APPLICATION OF VECTOR MAGNETIC FIELD DATA IN PREDICTING FLARES

K.R. Krall, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAS 8-33525)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0005, DATA ANALYSIS & MODELING OF ULTRAVIOLET SPECTROMETER & POLARIMETER EXPERIMENT & OTHER RELATED EXPERIMENTS FOR SOLAR MAXIMUM MISSION

S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAS 8-33526)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0006, MAGNETIC FIELD ANNIHILATION IN THE MAGNETOSPHERE AND SOME APPLICATIONS

S.I. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (EY-76-S-06-2229 005)

The magnetic field annihilation process has been believed to be one of the basic processes in cosmic electrodynamics, releasing a considerable amount of energy in a relatively short time, and has also been believed to take place in the tail region of the magnetosphere (manifested by magnetospheric substorms), in the planets (such as Mercury and Jupiter), in some comets, and in certain regions of the Galaxy. The one common feature in these regions is that the oppositely directed magnetic field regions are separated by a thin sheet-like region (often called the neutral sheet). We have been interested in energy-related geophysical problems in the arctic region. During the last 12 months, we helped corrosion engineers of the Alyeska Pipeline Co. in monitoring an induction current in the Trans-Alaska pipeline. We have found that electric currents of order 200 amperes are induced in the pipe during medium auroral activity. We are at present monitoring the amount of electric currents which leaks from short segments of an underground section of the pipe. We have also been interested in applying the audiofrequency (10 Hz to 10KHz) magnetotelluric method in sounding permafrost regions in Fairbanks. (ERDA 77-55)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

5.0007, INTERPRETATION OF LARGE GEOLOGIC FEATURES AND TRENDS ASSOCIATED WITH ALASKAN MINERAL OCCURRENCES BY MEANS OF ENHANCED SATELLITE IMAGERY

P.A. Metz, University of Alaska, Fairbanks Campus, School of Mineral Industry, *Fairbanks, Alaska* 99735 (G5195004; ASK-79-XPL (7))

OBJECTIVE: To interpret and correlate large geologic features and trends with known Alaskan mineral occurrences by means of enhanced satellite imagery.

APPROACH: Major mineral occurrences (approximately 250) will be plotted on a 1:1,000,000 base map. Computer enhanced ERTS imagery of Alaska will be examined to determine optimal spectral combinations for depicting linear and geometric features, lithologies, and alteration suites. Orientation, length, spacing, and density of linear intersections will be determined. Density of linear intersections and mineral occurrences will be contoured by trend surface techniques. Rose diagrams will be constructed. Data obtained from this research will complement existing projects on mineral resource evaluation and will be incorporated in a publication on the Geology and Mineral Resources of Alaska.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0008, COMPUTER STUDIES OF BAROCLINIC STABILITY IN SPHERICAL GEOMETRY

R.L. Gall, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (NAS 8-33815)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0009, INVENTORY AND HAZARDS MONITORING OF MINED LANDS USING AUTOMATED PROCESSING OF SATELLITE IMAGERY AND COLLATERAL DATA

C.E. Glass, University of Arizona, School of Engineering, Dept. of Mining & Geological Engineering, *Tucson, Arizona* 85721 (G5195005; ARZ-79-RES (1))

OBJECTIVES: Develop an operational program using satellite remote sensing data, collateral data, and automated image analysis to provide coal, uranium, and copper mine inventory, monitoring and reclamation of mined lands. Develop videotape seminars and short courses concerning the previously stated objectives.

PROCEDURES: Utilize computer mapping and analysis methods applied to remote sensor imagery and collateral data. Arizona will be the study area.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0010, VEGETATION MAPPING AND INVENTORY OF FOREST RESOURCES FOR SANTA CRUZ COUNT USING LANDSAT IMAGERY

N.H. Pillsbury, California State University & Colleges, California Polytechnic State University, School of Agriculture & Natural Resources, Dept. of Natural Resources Management, *San Luis Obispo, California* 93407 (NCA 2-678001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0011, ONE- AND TWO-DIMENSIONAL ATMOSPHERIC COMPUTER MODEL AND STUDIES

C.A. Riegel, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0012, MECHANISMS FOR THE EFFECT OF SOLAR VARIABILITY ON WEATHER

W.O. Roberts, Aspen Inst. for Humanistic Studies, *1919 14th St., Suite 811, Boulder, Colorado* 80302 (ER-78-S-02-4634)

To establish statistical relationships between parameters of variable solar activity and meteorological effects. To fit physical mechanisms to these statistical results, attempting to find plausible physical explanations for the various features of the relationships discovered through statistical analysis. To attempt to verify these proposed mechanisms using independent data.

RESULTS: In the 2 1/2 months of the current project, we have examined the effects of the passage of large solar plages across the solar disc on the circulation of the earth's atmosphere. As the plage approaches the center of the sun, the intensity of cyclonic circulation in the earth's atmosphere increases.

SUPPORTED BY U.S. Dept. of Energy

5.0013, REMOTE SENSING OF WATER QUALITY VIA LASER-RAMAN SPECTROSCOPY

M.C. Goldberg, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Denver, Colorado* (CR 71-176)

Water quality determinations in large lakes, estuaries or rivers are difficult at best by single point measurements. A remote sensing device capable of rapid scan over large areas would efficiently, and rapidly convey continuous water quality data to the water user and the hydrologist. This data would immediately give a quality map of basins, and estuaries. Such information cannot be obtained with present methods due to logistic and cost barriers. Remote methods cut cost, give continuous rather than point data, and reduce time of analysis from months to hours.

A study would utilize an array of lasers each operating at a particular frequency chosen to permit a 'fingerprinting' identification which utilizes the strongest absorptions of the particular compounds being sought, and detect laser-induced fluorescence of water contaminants. The energy source can be modulated and the 'fingerprinting' frequencies selected for maximum sensitivity. Laser light attenuation should be measured as a function of water composition, angle of incidence, water surface roughness and atmospheric interference. The laser frequencies and the details of light source modulation and detector design must be selected for maximum sensitivity. Sunlight interference can be simulated by superposing a sunlamp or actual sunlight onto the laboratory water sample.

A continuous wave laser, operating in the green red region will be used in conjunction with a detector package to evaluate the possibility of sensing surface films. Experience gained will be incorporated into a second phase which would be sensing and recording the sediment profile of surface waters. Use of a pulsed laser combined with a ranging detection system and a sweep field mounting would be incorporated into laboratory simulations to evaluate sensitivity and feasibility of this approach to remote sensing.

The project was inactive during FY 74.

Move to adequate space, set up a dual laser spectrometer system capable of examining dissolved solutes, suspended materials and solid surfaces. The limits of resolution and sensitivity for single component systems will be established.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0014, RADIONUCLIDE MIGRATION NEAR NUCLEAR EXPLOSION SITES, NEVADA TEST SITE

H.C. Claassen, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Bldg. 53 Denver Federal Ctr., Mail Stop 415 Box 25046, Lakewood, Colorado* 80225 (CR 77-207)

Approximately 90 nuclear devices have been exploded beneath the water table at Nevada Test Site. Although dissolved radionuclides have been identified in water collected from explosion cavities, the lack of documented migration of explosion-derived nuclides other than tritium has led to some complacency that the most hazardous contaminants are retained indefinitely at explosion sites. The mobility or immobility of specific radioisotopes must be documented by controlled field experiments at and near explosion sites.

The objective of the study is to determine as quantitatively as possible the degree of mobility of specific radionuclides in the natural media of Nevada Test Site. USGS/WRD objectives in the first of at least two experiments are: (1) determine the hydraulic properties of alluvium in the vicinity of the Cambric explosion sites in Frenchman Flat; (2) characterize the chemical quality of water and the changes resulting from the explosion; and (3) select a location and supervise construction and pumping of a well near the Cambric site. An additional objective is to identify sites for similar experiments in other media.

At the site currently being investigated and at future sites, the approach will be: (1) review of hydraulic and hydrochemical data to determine the probable natural characteristics; (2) drill through the collapsed rubble above and in the explosion cavity and pump water at several depths to determine chemical, radiochemical, and hydraulic properties; (3) pump water from a well located 3 to 5 cavity radii from the explosion point and sample for chemical and radiochemical analysis; (4) model the flow field and interpret data in terms of the model; and (5) prepare reports on experimental methods and results.

A total of 2.347 x 10**6 m**3 of water have been pumped from RNM-2S, a satellite well to Cambric Reentry site. A tritium breakthrough occurred about December 1977 and concentrations have steadily increased from below detection levels of 480 to 4.12 x 10**5 pCi/L without any indication of reaching a plateau. Quality of water samples from RNM-2S are very steady. A continuous record of water levels in three observation wells, including the pumped well, indicate near steady-state conditions.

Pumping at RNM-2S will continue, samples will be taken for tritium analysis 2 to 3 times per week. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0015, INVESTIGATIONS OF POINT AND NON-POINT SOURCE EMISSIONS THROUGH CONTROLLED AIRBORNE SAMPLING

J.A. Armstrong, University of Denver, Denver Research Inst., *University Park, Denver, Colorado* 80210 (R805926-02)

Lightweight remote controlled samplers which are carried aloft by tethered balloons have been developed to investigate particulate and gaseous emissions from point and non-point sources. The sampling systems have both vertical and horizontal mobility and are capable of sampling at selected altitudes for relatively long periods of time. meterological packages are also attached to the balloons so that the ambient temperature, wet bulb temperature, and pressure are monitored at the same time as the sampling operations.

To date, the systems have been used to sample fly ash emissions from the plumes of coal fired power plants. Field programs to investigate the effects of flue gas conditioning on the emissions from a power plant burning low sulfur western coal and to investigate the particulate and gaseous constituents of the plume from a portland cement plant are planned for the near future.

During the second program year efforts will continue to quantify the impact of conditioning treatments on power plant emissions. The balloon-borne samplers will also be used to monitor other point and non-point source emitters where sampling from the ground, from towers, or by aircraft is impractical.

SUPPORTED BY U.S. Environmental Protection Agency

5.0016, CHARACTERIZATION OF GLASSY SILICATE SPHERULES IN DEEP-SEA SEDIMENTS

B.P. Glass, University of Delaware, School of Arts & Sciences, Dept. of Geology, *Newark, Delaware* 19711 (OCE77-08319 A01)

This research project is investigating the geographical distribution patterns, age of deposition, and the physical and chemical properties of small, glassy particles (microtektites) which have been observed in deep-sea sediment cores. The origin and significance of these glassy objects has been the subject of considerable discussion since their discovery about fifteen years ago. One interpretation is that they represent the direct input of extra terrestrial material after falling through the atmosphere and settling through the water column. Alternatively, they may reflect the impact of large extraterrestrial objects with the earth's crust and the re-melting of the earth's crust into glassy droplets which 'splashed' outward over a large portion of the earth's surface. The basic objective of the research is to determine the origin of these glassy objects, and use the results to interpret the history of extraterrestrial source materials to the earth's surface. The results also provide a means for precise stratigraphic control in particular age intervals of deep sea sediments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0017, SEA SURFACE SATELLITE THERMAL RESOURCE DATA

G. Maul, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., Atlantic Oceanic & Meteorological L b., *15 Rickenbacker Cswy., Miami, Florida* 33149 (EX-76-A-29-1041,T.O.-T018)

The objective of this project is to provide an analytical tool for synoptic assessment of thermal resource and biota variations at sites of probable OTEC locations via satellite imagery. The project also provides a synoptic assessment of principal variant (sea surface temperatures) in OTEC thermal resources. The final scope of effort of this project is contingent upon related resource assessment projects.

The suggested scope of effort is to: a. Determine OTEC thermal resource data requirements by review of existing system and subsystems specifications. b. Assess the state of practice in thermal IR imagery via satellite and compare to OTEC requirements. c. Develop a methodology for acquiring relevant data and apply to OTEC resource assessment. d. Prepare a scheme for OTEC operational usage of satellite data. e. Analyze existing IR data and include this information in OTEC data summaries/atlas(es). f. Acquire and analyze oceanic optical properties for plant impact assessment.

BIBLIOGRAPHIC REFERENCES: Maul, G., de Witt, T.P., Yanaway, A., and Baig, S. Geostationary Satellite Observations of Gulf Stream Meanders: Infrared Measurements and Time-series Analysis, Journal of Geophysical Research. No. 83, C-12, pp. 6123-6135 (1978).

SUPPORTED BY U.S. Dept. of Energy, Office of Solar Geothermal Electric & Storage Systems

5.0018, GEOHYDROLOGY OF SINKHOLES, WEST-CENTRAL FLORIDA

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Sinkholes are an important avenue of recharge to the Floridan aquifer as well as a potential source of pollution. Aquifer stress caused by ground-water withdrawals accelerates sinkhole development, particularly during dry periods when pumpage is at a maximum and head difference between the surficial and artesian aquifer is greatest. Cases of sinkhole collapse and land subsidence due to the effects of pumpage have been documented. Occurrence of sinkholes in highways and in land adjacent to well fields is common. Because of the increasing demands for water in the near future, it is anticipated that the frequency and magnitude of sinkholes near well fields may increase.

Develop an understanding of sinkholes and their relation to the hydrologic system by relating sinkhole occurrence, density, and type to ground-water withdrawals, and to geohydrologic factors such as topography, drainage patterns and densities, confining-bed thickness, solution features in the limestone, head differences between surficial and artesian aquifers, and drought or flood conditions. Develop a classification of sinkhole types and potential of occurrence in selected well-field areas. A map of sinkhole-prone areas of Southwest Florida Water Management District will be compiled.

A terrain analysis of the study area will be made using parameters such as areas of internal drainage, size, shape, density and interrelations of sinkholes, thickness of overburden, confining-layer thickness, and head difference between Floridan and surficial aquifers. In addition, well-field records will be researched for quality-of-water data, pumpage records, and reported sinkhole occurrences.

Study sinkhole density, size, shape, interrelationships, on existing aerial photos and photomaps in selected areas. Research well-field records for quality of water data, pumpage records, and reported sinkhole occurrences. Field check selected sinks. Attempt spatial analysis of sink density and relationships. Attempt correlation of sink size, shape, interrelationship with head difference, confining bed thickness, occurrence on terraces of known geologic age. Compile final map of areas of internal drainage, evaluate data and write report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0019, NORTH PACIFIC EXPERIMENT (NORPAX) - EXCHANGE OF EQUATORIAL PACIFIC WATERS FROM TRITIUM STUDIES

R.A. Fine, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (OCE78-22120)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with scales of months to years and space scales in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

One major component of NORPAX is a coordinated field program to determine the space and time variability of the density and velocity fields in the upper layers of the Equatorial Pacific current system. This field program will occur between February 1979 and July 1980 and will involve the efforts of a number of scientists. Measurements will be made from ships, airplanes and moored and drifting instruments.

This grant will fund Drs. Fine and Ostland to do the logistics and analysis of tritium on the Equatorial shuttle. Initially, several hundred samples will be taken on two legs of the shuttle. Tritium and hydrographic data will be used to estimate the exchange rates between equatorial current systems and the quantitative importance of meridional transport to the data will

be used to estimate the exchange rates between equatorial current system and the quantitative importance of meridional transport to the upwelling process.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0020, MODIFICATION OF A COMPUTER GENERAL CIRCULATION MODEL OF THE EARTH'S ATMOSPHERE FOR THE ATMOSPHERIC GENERAL CIRCULATION EXPERIMENT

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SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

5.0021, PROGRAM FOR SOLAR ENERGY METEROLOGICAL RESEARCH AND TRAINING SITES

C.S. Ramage, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Meteorology, *2444 Dole St., Honolulu, Hawaii* 96822 (EG-77-G-03-1617)

We plan to modify, and where necessary, expand or contract the solar radiation and anemometer networks now operating in Hawaii so that in time we shall be able to estimate with some confidence the solar energy potential and its annual and diurnal variations at any point in the islands. Careful routine comparisons of radiometers with a sub-standard and calibration of anemometers in our wind tunnel would ensure high-quality measurements. Our already extensive list of courses relevant to solar energy would be supplemented by more focused courses in meteorology and engineering, incorporating laboratory work at solar radiation and wind field sites and emphasizing relationships between input and energy output. Seminars and workshops would reach and inform a wider, non-academic audience. Research, involving both graduates and undergraduates, would explore the underlying physical causes of diffuse radiation and of terrain-effects on radiation, of fluctuations in the trade wind inversion and their influence on surface wind speeds. We would also determine whether cloudiness monitored from satellites, and rainfall measured by recording gauges, could be correlated with direct measurements of radiation. Throughout we would seek to improve the quality of radiation and wind forecasts out to about 36 hours. Developments in numerical modelling would be tested and any that performed well, applied.

SUPPORTED BY U.S. Dept. of Energy

5.0022, FRACTURE CONTROL OF COEUR D'ALENE ORE DEPOSITS

R.R. Reid, University of Idaho, College of Mines & Earth Resources, Dept. of Geology, *Moscow, Idaho* 83843 (G5195012; IDA-79-XPL)

OBJECTIVE: Delineate new exploration targets for base metals in Northern Idaho's Coeur d'Alene mining district through study of regional distribution of fractures by remote-sensing methods combined with surface mapping and analysis of fracture control of underground ore bodies in operating mines.

APPROACH: Examine ore control of existing bodies and search for new in-mine exploration targets using remote-sensing imagery data and digital data combined with surface mapping techniques. The linear study will gather (1) known surface traces and trends of ore bodies, faults, and fractures, (2) available information on foliation attitudes of host rocks, and formation contacts, and (3) data on ore body orientation and orientation of ore body related fractures. Starting from the thesis that the bulk of the Coeur d'Alene ore bodies is fracture controlled, this project will attempt to develop a fuller knowledge of fracture patterns to recognize favorable new ideas for exploration on district-wide and individual mine bases. Efforts will address ground truth for various various fracture systems disclosed by linear analysis primarily at operating mines and other favorable-appearing target areas. Stratigraphic and chemical work will investigate the possibility of strata-bound sulfides in the Silver Belt.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0023, MODELS FOR ABUNDANCES OF VOLATILE MATERIALS IN ATMOSPHERES OF TERRESTRIAL PLANETS & FOR THE INTERIORS OF URANUS & NEPTUNE (ABBREV)

A.S. Grossman, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NCA 2-340002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0024, PLANNING STUDY FOR URBAN STORM-WATER-QUALITY INVESTIGATIONS IN THE SUB-HUMID PLAINS AREA

L.M. Pope, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Lawrence, Kansas* 66044 (KS 79-104)

The U.S. Geological Survey under interagency agreement with the Environmental Protection Agency, will implement a program of studies to evaluate water-quality and water-quantity problems as associated with urban-stormwater runoff in several major cities nationwide. The studies will provide a data base for a wide geographic distribution. Because distribution densities and physiographic and climatic conditions will vary widely and will be unique to each area, prototype work plans must be developed regionally in order to arrive at a nationally consistent data base for urban hydrology.

To conceive a regional work plan for an urban-stormwater quality study to be made in the sub-humid plains area. The plan will detail procedures for (a) selection of basin(s) to be studied, (b) selection of data collection sites, (c) designation of the principal parameters and frequency for hydrologic data collection, and (d) definition of approach for evaluation and interpretation of the data.

The general approach for the preparation of the 'prototype' work plan will be to (1) select a typical urban watershed in the sub-humid plains area where an urban stormwater-quality study is considered feasible; (2) compile information on basin boundaries, basin characteristics, and storm-sewer network; (3) compile land use maps and aerial photos to determine various land uses and percentage of each within the basin; and (4) define hydraulic characteristics of the basin in relation to sampling site selections and suitability of sites for instrumentation.

Select a typical urban watershed and compile basin characteristics.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0025, DEVELOPMENT & DEMONSTRATION OF A LONG RANGE TRACER SYSTEM

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OBJECTIVE: This project will provide meteorological assistance in describing and interpreting air quality in the Western U.S. from existing or proposed energy resource activities.

APPROACH: Energy development sites will be surveyed, existing or proposed air quality and meteorological monitoring networks will be surveyed and assessed, and environmental impact from future sources will be predicted. Selected air quality measurements will be analyzed, using meteorological trajectory and removal data.

PROGRESS: Recommendations for augmenting or modifying existing networks will be made, and meteorological support will be provided for ambient air monitoring performed in EPA Energy Accomplishment Plan 81 ABF.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Office of Environmental Processes & Effects Research

5.0026, EVALUATION OF THE PROPOSED MICROWAVE SOUNDING UNIT

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0027, JOINT US-USSR MID-OCEAN DYNAMICS EXPERIMENT (POLYMODE) - THEORETICAL STUDIES OF LAGRANGIAN KINEMATICS AND DYNAMICS AND GULF STREAM RINGS

G.R. Flierl, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (OCE77-28350)

This project is part of POLYMODE. The long range goal of POLYMODE is to understand the role of the mesoscale eddies in the general circulation of the ocean.

This project includes theoretical work on two separate but overlapping problems in mesoscale oceanic theory: Lagrangian Kinematics and dynamics, and Gulf Stream Ring modelling. The Lagrangian problems study the movements of submerged floating particles such as Sofar floats, water with special chemical or temperature-salinity characteristics, or biological matter. The kinematic studies deal with the trajectories of particles in a given flow field (e.g. the velocity field of a moving Gulf Stream Ring) or in a turbulent flow field with given statistics. The dynamical studies will consider the simplification of the Lagrangian equations of motion under the standard constraints characterizing mesoscale motions--long time and length scales and dominantly geostrophic, hydrostatic force balances. Applications to oceanic experiments will be considered.

The Gulf Stream Ring studies will include calculations of the ability of one of these mesoscale vortices to carry particles along with it as it moves through the ocean. Dynamical models of the rings will be studied to determine which physical effects cause or inhibit translation, distortions of the circular shape, dispersion (formation of neighboring highs and lows by wave radiation), and decay. The existence and properties of 'Solitary waves' with a circular shape will be investigated. In these waves, the nonlinear terms in the equations of motion counteract the terms which tend to cause dispersion, leading to an eddy of a long-lived nature.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0028, DISPERSAL OF COAL DUST FROM TRANSSHIPMENT AND POWER PLANT STORAGE FACILITIES

M. Syder, University of Minnesota, Duluth Campus, School of Letters & Science, Dept. of Physics, *331 Science, Duluth, Minnesota* 55812 (R806020-02)

Rapid methods for sampling and identification of particulates will be used to study the dispersal of wind-borne particulates from power plants and validation of numerical models for dust dispersal. A numerical model based on statistical solution to the gradient transfer problem has been developed for this project. The model will be validated at a test site in Minnesota.

Rapid detection of dustfall has been made possible by optically scanning for spherical fly ash on particle by particle basis. The method has been developed here for examination of particle shapes in suspended solids.

Samples will be collected at the Cohasset Power Plant for various wind episodes and scanned optically to determine dustfall rates as a function of winds for model calibration purposes. Subsequently, the model will be used to determine yearly deposition rate and distribution of fly ash fallout around the plant. Prediction of the long term accumulations will be checked by examination of dustfall accumulated in snow. Snow surface reflectivity monitored at ground and from satellite offers a possible check on the determination of the distribution of dustfall.

SUPPORTED BY U.S. Environmental Protection Agency

5.0029, POLLUTANT MONITORING BUOY DEVELOPMENT

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OBJECTIVE: To develop buoy systems for measuring limited parameters in areas of hazardous material spills. The buoys will be stored and maintained in an operational readiness state, be easily transportable to a deployment site in the coastal waters of the United States, and be deployed from 82-foot or larger vessel of opportunity without special handling equipment. The program goals are for a production cost of approximately $15,000 per buoy.

APPROACH: To use a modified, off-the-shelf microprocessor-based data system for acquiring the data and transmitting it via the GOES satellite.

CURRENT PLANS AND PROGRESS: A new hull design being completed by April 1980 will then be developed for use in the prototype testing.

SUPPORTED BY U.S. Dept. of Commerce, Office of Ocean Engineering, National Data Buoy Office

5.0030, TECHNIQUES OF FLOOD-PLAIN MAPPING FOR LAND-USE MANAGEMENT OF FLOOD PLAINS

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Identification of lands subject to flooding is necessary for land-use management on flood plains. Accurate delineation on maps, of areas subject to inundation by floods of a given frequency is required--information on frequency of flood discharges, profiles of water-surface elevations along the channel, and large-scale topographic maps. Information obtained during field surveys is needed for computing water-surface profiles by step-backwater procedures. New techniques of photogrammetry, electronic measurement from aircraft, computation of backwater profiles, and the plotting of maps and cross sections by computer may offer more efficient means of flood-plain delineation.

To evaluate potential flood-mapping techniques, appraise their accuracy in relation to cost for various uses and time frame in which flood-plain maps are of maximum use, and to investigate means to carry out flood-mapping techniques at an accelerated rate.

Investigate and compare available methods of obtaining data required for preparing maps, charts, and interpretive reports associated with identification of flood-prone areas. Determine the range in costs involved in the conventional aerial photography-stereo model approach of obtaining measurements of valley cross sections. Investigate the potential of the laser altimeter in its application to aerial surveying, and the possibility of direct survey from the air without going through the stereomodel plotting process.

The fabrication phase of the contract work begins at Draper Lab Oct. 1, 1978 and because of budgetary constraints will likely span a 3-year period. The department has authorized USGS to include a $3.6 million item for this work in its FY'80 budget request. This would leave $770k to be requested for FY'81, assuming no added costs were incurred due to the time stretchout. About $1 million of unused inertial guidance hardware is being drawn from other Draper Lab contract work for adaptation to the USGS' APT system at substantial savings. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0031, PREDICTION OF SUBSIDENCE ASSOCIATED WITH UNDERGROUND COAL MINING

D.J. Barr, University of Missouri, Rolla Campus, School of Engineering, Dept. of Mining Petroleum & Geological Engineering, *Rolla, Missouri* 65401 (G5195025; MSR-79-XTR (2))

OBJECTIVES: To develop a predictive model for subsidence and ground stability in the Interior Coal Province.

APPROACH: Using an existing remote sensor image processing system and interactive data base software programs, a set of geographically referenced files of digitized topographic, stra-

tigraphic and structural geologic data will be created along with corresponding underground mine layout, extraction characteristics and underground operation conditions. The files of digitized surface and subsurface geologic features will be constructed for an area of known subsidence over existing underground coal mines in the Illinois coal basin. The relationships of spatial geologic data (including subsurface geology, surface lineaments, topography and drainage features) to depth and shape of mine workings; mine roof, pillar and floor stability; and surface subsidence effects will be determined. That combination of features which constitutes the predictive relationship for known conditions will then be tested in other areas of similar geology and mine practice in order to establish measures of accuracy and reliability.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0032, AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCES PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA
R.E. Stoiber, Dartmouth College, School of Arts & Sciences, Dept. of Earth Science, *P.O. Box 833, Hanover, New Hampshire* 03755 (NCC 5-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, NIGHT-TIME/DAY-TIME ORBITAL SURVEY OF LIGHTNING EXPERIMENT SUPPORT
M. Brooks, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (NAS 8-33817)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0034, PRECIPITATION-RUNOFF MODELING OF WATERSHED SYSTEMS IN NORTHWESTERN NEW MEXICO
H.R. Hejl, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Albuquerque, New Mexico* (NM 79-333)

The effects of surface mining for coal on the quantities and quality of surface flow systems in the strippable coal-lease area in the San Juan Basin during a period of change in land use are unknown. The Bureau of Land Management needs to predict the effects of surface mining on the water resources in the coal-lease areas in order to manage the coal-bearing areas of the public domain.

Develop, test, and verify precipitation-runoff models for predicting surface runoff characteristics and sediment yield under various land-use conditions in the coal-lease areas in northwestern New Mexico. The emphasis will be on relating parameters used by the model to measurable physical features of a selected watershed basin to facilitate transferability of the model from an instrumented basin to uninstrumented basins.

A selected watershed basin with a drainage area of less than 10 square miles in the strippable coal-lease area in the San Juan Basin will be instrumented for collecting streamflow data for quantity and quality of water, precipitation data, soil-moisture data in the root zone, and meteorological data. Data will be tested in the basic precipitation-runoff model development by the modeling group in the Central Region office, as it is collected, to aid in refinement of data collection and model development. The basic model is a modular package using a distributed-parameter approach. The long-term rainfall required as the driving variable for the model will be generated with a stochastic model from short-term rainfall records collected throughout the coal-lease region of San Juan Basin.

Operation of streamflow gaging station, recording raingage, PS-69 automatic pump sampler, and single-stage sampler at the selected watershed basin for precipitation-runoff modeling. Additional instrumentation to be installed and operated will include four recording raingages over the basin and meteorological station which will collect data on relative humidity, air temperature, wind speed, wind direction, and solar radiation. Soil-moisture observation wells will be installed in the watershed and monitored periodically. The operation of these recording raingages throughout the coal lease region will be a part of the project.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0035, ANALYSIS OF INTERMEDIATE WAVELENGTH ANOMALIES OVER THE OCEANS IN MAGNETIC FIELDS MONITOR SATELLITE AND SEA SURFACE DATA
J. LaBreque, Columbia University, Graduate School, *109 Low Memorial Library, New York, New York* 10027 (NAS 5-25891)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0036, AIRBORNE SPECTRORADIOMETER TECHNIQUES FOR MINERAL EXPLORATION IN FORESTED TERRAIN
J.T. Kuo, Columbia University, School of Mines, *Broadway & W. 116th St., New York, New York* 10027 (DAR78-16320)

The purpose of the project is to investigate and verify the phenomenon of detecting plant stress, due to toxic metals in the soil, by spectral radiation. If the phenomenon is verifiable, as it appears to be, a method of prospecting for buried ore bodies in forested areas can be developed. The prospecting method would utilize a spectroradiometer and aircraft for rapid transects over an area of interest.

The project consists of: (1) a comprehensive analysis of existing spectral data obtained over known ore bodies, (2) geochemical and biochemical analyses of plant and soil samples obtained at the same sites as the spectral data and (3) controlled botanical experiments in the laboratory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

5.0037, THE MOTION OF CIRCUMPLANETARY PARTICLES - THE ORIGIN AND EVOLUTION OF PLANETARY RINGS, AND POSSIBLE DUST COATINGS OF REGULAR SATELLITES
J.A. Burns, Cornell University, Ithaca Campus, School of Engineering, Dept. of Theoretical & Applied Mechanics, *242 Carpenter Hall, Ithaca, New York* 14853 (NCA 2-175001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0038, DATA ANALYSIS AND MODELING OF ULTRAVIOLET SPECTROMETER AND POLARIMETER EXPERIMENT AND OTHER RELATED EXPERIMENTS FOR SOLAR MAXIMUM MISSION
S.T. Wu, Rensselaer Polytechnic Inst., Graduate School, *110 8th, Troy, New York* 12181 (NAS 8-33562)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0039, DEMONSTRATION PROJECT TO EVALUATE THE UTILITY OF OPERATIONAL APPLICATIONS OF LANDSAT TO COUNTY AND LOCAL GOVERNMENT AGENCIES
P.R. Baumann, State University of New York, College at Oneonta, School of Arts & Sciences, Dept. of Geography, *Oneonta, New York* 13820 (NAS 5-25967)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0040, PLANETARY ATMOSPHERES RESEARCH
T. Owen, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NCC 5-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0041, AUTOMATED TECHNIQUES FOR MAPPING URBAN LAND COVER WITH REMOTE SENSING DATA
R. Craig, Kent State University, School of Arts & Sciences, Dept. of Geology, *Hilltop Dr., Kent, Ohio* 44240 (NAS 5-26111)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0042, SERVICE, MATERIALS AND PERSONNEL NECESSARY TO PROVIDE CORRELATIVE DATA EFFORTS FOR WFC FIELD MEASUREMENTS OFFICE
J.K. Luers, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 6-3086)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0043, HYDROLOGIC MODELING COAL CREEK BASIN NEAR LEHIGH, OKLAHOMA (EMRIA)
S.J. Playton, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Oklahoma City, Oklahoma* (OK 78-049)

Coal underlying about 375,000 acres in the eastern Oklahoma coal field is Federally owned. The Bureau of Land Management is charged with the responsibility of assessing probable water-resource impacts and reclamation capabilities of any area under Federal jurisdiction in which surface mining for coal might occur. None of the studies so far underway in Oklahoma's coal fields specifically addresses the problem of predicting effects on water resources of extracting coal by surface mining techniques. A study by the U.S. Geological Survey, in cooperation with the Bureau of Land Management, is under way.

The study's primary objective is to collect and interpret sufficient hydrologic data to predict and assess the effects of surface mining for coal and subsequent reclamation efforts on hydrologic characteristics. A secondary objective is collection of sufficient hydrologic data so that baseline hydrologic conditions can be defined and possible changes occurring after mining takes place can be documented.

Development, calibration, and verification of a watershed model is the approach to be used to aid prediction of future effects of surface mining for coal. The data required for such a modeling effort are sufficiently complex and expensive as to render modeling large areas unfeasible in terms of available money and manpower. Oklahoma District's study will be concentrated in one basin, the Coal Creek basin near the town of Lehigh in Coal County, Oklahoma.

All instrumentation for necessary data collection was purchased and installed in FY78. Included are a stream-gaging station, a climatological data-gathering station, continuous water-quality monitor, automatic water sampler, 4 precipitation gages, neutron-probe access tubes, 3 crest-stage gages, and 2 batteries of single-stage sediment samplers. After installation, operation commenced on a part-year basis.

All installed instrumentation will be operated and maintained, and hydrologic data necessary for model calibration and establishment of base line conditions will be collected. A detailed geologic map of the area will be prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0044, SOLAR ENERGY METEROLOGICAL RESEARCH AND TRAINING SITE
E.W. Hewson, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Sciences, *126 Agricultural Hall, Corvallis, Oregon* 97331 (EY-77-G-06-1059)

The project objectives include: (1) to establish a primary solar radiation and related meteorological measurements and research facility at Oregon State University, Corvallis; (2) to develop an academic year training program at Oregon State University with new courses on the theory and measurement of solar radiation; (3) to conduct summer workshops on solar energy measurement and instrumentation techniques and to organize a seminar series on solar energy related topics; and (4) to expand the statewide network of solar radiation monitoring stations, presently maintained by the University of Oregon, Eugene, to include the remaining four states of the region. Planned activities include: (1) radiation climatology of the Pacific Northwest; (2) passage of solar radiation in clouds and fogs; (3) radiative transfer in cloudy, turbid atmospheres; (4) multispectral radiometric and polarimetric investigations of atmospheric turbidity; (5) radiative properties of surfaces; (6) photometry of the daytime sky; and (7) interpolation among solar radiation measurement stations in mountainous terrain.

SUPPORTED BY U.S. Dept. of Energy

5.0045, INFRARED HETERODYNE OBSERVATION OF THE STRATOSPHERE FROM BALLOON BASED PLATFORM
M.M. Abbas, Drexel University, School of Science, Dept. of Physics & Atmospheric Science, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NCC 1-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0046, CHEMICAL ANALYSIS OF VEGETATION SAMPLES
C.B. Smith, Pennsylvania State University, University Park Campus, School of Agriculture, Dept. of Horticulture, *201 Ag. Admin. Bldg., University Park, Pennsylvania* 16802 (NAS 5-25996)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0047, WATERBORNE ORGANIC MATTER ANALYSIS
J. Yungel, West Chester State College, Undergraduate School, Dept. of Earth Sciences, *West Chester, Pennsylvania* 19380 (NAS 6-3096)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0048, IMPROVING ESTIMATES OF STREAMFLOW CHARACTERISTICS IN COAL MINING AREAS WITH DIGITAL LAND-COVER DATA FROM SATELLITES
E.F. Hollyday, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *A 413 Federal Bldg., U.S. Courthouse, Nashville, Tennessee* 37203 (TN 79-039)

The government needs to judge the adequacy of proposed reclamation plans submitted by coal strip-mine operators. This judgment in part must be based upon the best available estimate of natural streamflow. These estimates may be made by transferring streamflow records from gaged to ungaged sites by techniques of regionalization that involve multiple regression of basin characteristics with streamflow characteristics. Studies have shown that basin characteristics measured from satellite data can improve the accuracy of these estimates in other regions.

The primary objective is to improve upon the regression equations used to estimate streamflow in areas affected by coal mining in the Cumberland Plateau by using land-cover information derived from digitally processed LANDSAT data as well as maps. The digital data will update the land-cover data base for the New River basin project 'Hydrologic Effects of Coal Mining'.

The usefulness of the digital land-cover data base, developed from LANDSAT tapes and available map data, will be tested by an experiment designed to compare two sets of regression equations, one containing the most up-to-date, but routinely-derived, basin characteristics, and the other containing the gee-whiz basin characteristics derived from LANDSAT tapes and available maps.

Acquire base map; transfer drainage divides to base; measure value of map-derived basin characteristics; acquire LANDSAT tapes; let data-processing contract; classify terrain based upon field reconnaissance and available imagery; transfer classification to base map and measure land-cover data by drainage basins; run regressions of streamflow characteristics vs. basin characteristics; interpret; draft report; publish report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0049, PROJECT DA VINCI MANNED SCIENTIFIC BALLOON EXPEDITION

Unknown, Inst. for Storm Research Inc., *Houston, Texas* 77006 (EY-76-C-05-4763)

SUPPORTED BY U.S. Dept. of Energy

5.0050, DIAGNOSTIC ANALYSIS OF THE ENVIRONMENT OF SEVERE STORMS USING ATMOSPHERIC VARIABILITY

J.R. Scoggins, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (NAS 8-33776)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0051, SOLAR POWER SATELLITE MICROWAVE/ IONOSPHERE INTERACTION STUDY

J. Clynch, University of Texas, Austin Campus, Applied Research Lab., *200 W. 21st, Austin, Texas* 78712 (NAS 9-16086)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0052, LIGHT SCATTERING BY NONSPHERICAL PARTICLES

K. Liou, Utah Higher Education System, University of Utah, School of Science, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NCA 2-821001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0053, DEVELOPMENT OF DATA PROCESSING

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0054, COORDINATION OF WRD INSTRUMENTATION

R.W. Paulson, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (WD 72-070)

Increasing requirements by WRD Districts for the supply of instrumentation, and by the WRD data collection program for new and better data define a need for coordination of instrumentation development and supply. Moreover, there needs to be a focal point through which WRD's instrumentation program is represented to other government agencies, foreign hydrologic activities, and instrument development companies in the private sector.

To establish an instrumentation coordination function within the WRD.

During the period FY77-79 WRD has established a hydrologic instrumentation facility at NSTL Station, Miss., to provide a central facility to supply, repair, and develop WRD instrumentation. The resources of this facility and the WRD's satellite telemetry research program are the principal activities being coordinated to insure that WRD priorities are met. With time the scope of coordination will expand.

Significant progress was made in defining the role of the Hydrologic Instrumentation Facility (HIF). A HIF Building was begun. A proposal from COMSAT General was received for a real time hydrologic data collection pilot program.

Staff the HIF and complete removal of all significant instrumentation activities from Reston. Finish negotiating a contract with COMSAT General. Finish program planning for an instrumentation development effort by the HIF.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0055, EVALUATION OF A COMSAT GENERAL PILOT PROJECT TO PROVIDE THE USGS WITH A REAL-TIME HYDROLOGIC INFORMATION SERVICE

W.G. Shope, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (WD 79-142)

The Water Resources Division has identified numerous needs and benefits for real-time hydrologic data telemetered from remote data collection sites. Acquisition of real-time data will allow better operation of the data collection network and permit timely delivery of critical data to the water user community. Because of limited manpower and ever-expanding technology, it would be very difficult, if not impossible, for WRD to provide extensive support to real-time data activities.

To evaluate the hydrologic information services proposed by COMSAT General and to develop specifications for a 5-year, 2,000-site, real-time network that will be contracted in 1981.

The pilot project calls for a 101-site network that includes Virginia (1), Pennsylvania (20), Massachusetts (20), Florida (15), Colorado (20), Arizona (15), and Washington (10). The contractor will be responsible for acquisition (sensors), collection (satellite telemetry), screening (error checks, alerts), and dissemination (teleprocessing). Data will be delivered to the Reston Honeywell computer in real-time where it will be available for interactive processing by WRD users. Once each day the data will be transferred to WATSTORE from the Honeywell computer. The project will be managed and evaluated by the Chief, WRD Data Relay Project, and participating Districts.

Select 101 sites, begin operations under the contract, and evaluate results of preliminary reports from the contractor on instrumentation and system performance. These data will be used to formulate specifications for an operational real-time data collection service involving more than 2,000 sites.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0056, MICROWAVE REMOTE SENSING

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 73-088)

The project office is involved in a wide variety of remote sensing and ground truth work in the Arctic Ocean through the AIDJEX (Arctic Ice Dynamics Joint Experiment) and POLEX (Polar Experiment) organizations, and in the Gulf of St. Lawrence and Lake Ontario through NASA's SKYLAB program and the International Field Year for the Great Lakes (IFYGL). The imagery from ERTS-1 and NOAA-2 satellites have provided us with the first large-scale high resolution imagery of the sea ice canopy. Also the first all-weather, all-time synoptic imagery of the Arctic ice canopy is provided by the ESMR imagery from NIMBUS 5. It is necessary to compare the various data with surface data to get some idea of the gross dynamics and morphology of the Arctic canopy. Comparison of this satellite data with surface data from the Gulf and Lake Ontario areas will give us a picture of the gross dynamics and morphology of these regions.

The AIDJEX-NASA aircraft data and surface ground truth data have given us the means of distinguishing multiyear ice, first year ice, and water by means of microwave imagery of the ice canopy. Canadian and Creel scientists and NASA and Canadian aircraft will provide us with important aircraft data and ground truth measurements of fresh water and sea ice on the Gulf of St. Lawrence and Lake Ontario. However, in order to properly estimate the amount of each form and its metamorphosis it is necessary to cross-correlate the high resolution ERTS-1 and NOAA-2 imagery with the low resolution microwave imagery. Once this is done, select areas of the Arctic ice canopy where AIDJEX ground truth data is available will be studied and selected areas in the Gulf and Lake Ontario where SKYLAB data and ground truth measurement are available will be studied. These data will be very useful to help in the planning of the main AIDJEX experiment to take place in 1975-1976 and for future POLEX experiments.

The project office receives ERTS-1 data from several sources and NOAA-2 data from the National Environmental Satellite Service. The ESMR data comes slowly from Goddard Space Flight Center to the project office, and NASA SKYLAB

data will be available also covering the Gulf of St. Lawrence and Lake Ontario. *(Text Abridged)*

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0057, ELECTROMAGNETIC METHODS FOR MEASURING SNOWPACKS

M.F. Meier, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 73-101)

Snow is an important water resource in many areas, but it changes rapidly and is difficult to measure. No method currently exists for measuring water equivalent (mass) or free-water content (wetness) of snow remotely. The latter characteristic cannot even be measured at a station with sufficient accuracy for many hydrologic or remote-sensing purposes.

Develop better understanding of electromagnetic properties of snow, especially absorption, volume-scattering, and back-scattering. Devise instruments to be used in the field to make these measurements and to obtain hydrologically useful data. Adapt these instruments to remote (airborne) systems.

Study theory, do numerical modelling, develop instruments, test these in the field, and design prototype systems. Investigate swept-frequency radar, electrical resonance-width, and microwave-absorption methods, and other innovative techniques.

No funding was provided this year, but cooperation did continue with Dr. Linlor. A profiling snow-wetness (liquid water content) meter using active microwave absorption was completed and testing begun in snow. This instrument and others were used to determine radar parameters of snow.

Continue modest cooperative effort.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0058, 1980 LAND COVER CLASSIFICATION FOR THE PUGET SOUND REGION

R.D. Shinn, University of Washington, School of Architecture & Urban Planning, *Dept. of Urban Planning, Seattle, Washington* 98105 (NCA 2-850001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0059, BOMB RADIOCARBON SECTIONS ALONG THE HAWAII-TAHITI SHUTTLE TRACK

Unknown, University of Washington, School of Arts & Sciences, Dept. of Geological Sciences, *Seattle, Washington* 98105

SUPPORTED BY U.S. Dept. of Energy

5.0060, NONPOINT-SOURCE POLLUTION FOR URBAN AND RURAL AREAS IN LOWER FOX RIVER BASIN

P.E. Hughes, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Madison, Wisconsin* (WI 79-096)

Methods for estimating nonpoint-source pollutant loading from different land-use types and intensities in urban and rural areas are required to develop effective water-quality-management plans. Before such pollution can be controlled adequately, better methods are required to identify source areas, determine quantity and quality of runoff, and correlate change in loads with change in land-use practices or management.

Determine nonpoint-source pollutant loads in urban and rural streams. Estimate effects of change in land-use practice or management on loads. Test the application of several water-quality models for estimating loads. Evaluate remote sensing techniques for land-use characteristics for water-quality modeling.

Streamflow and water-quality data will be collected at 2 urban sites and one rural site which are representative of different types of land use. Land-use data will be determined by the University of Wisconsin from high altitude and LANDSAT imagery. Four water-quality models will be calibrated and verified, and their results compared for accuracy. Nonpoint-source pollutant load will be computed for the basin using best model.

Establish 2 urban and 1 rural watershed-monitoring stations. Rate stations and collect water-quality samples for 9 or 10 storms. Monitor streamflow and precipitation in basin. Select water-quality models for evaluation, and perform initial calibration of models.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0061, MEASUREMENT OF AIRBORNE AND PRECIPITATION RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION

R. Reiter, Institut fur Atmospharische Umweltforschung der Fraun. Gesel, *Kreuzeckbahnstrasse 19 Frg, Garmisch Partenkirchen, Federal Republic of Germany* (EY-76-C-02-3425)

The influx of stratospheric air into the biosphere is studied with the objective to obtain information about the frequency distribution of stratospheric intrusions as a function of seasonal and inter-annual variations. Stratospheric intrusions are indicated by high concentrations of the cosmogenic radionuclides Be7, P32, P33, and the ozone, measured at the mountain observatory Zugspitze (300 m a.s.l.). The transport of stratospheric air into the troposphere is determined on the basis of the isentropic trajectory analysis. The forecasting of stratospheric intrusions is performed based on observations of the variation of the relative humidity in the upper troposphere.

The quality of the forecasting technique is subjected to a statistical examination.

Aerosol layers in the stratosphere are measured by means of a lidar system.

RESULTS: It has been possible to prognosticate the fallout of the Chinese nuclear test of 25 September 1976. The forecasts of the influx intensity of stratospheric air into the biosphere came exactly true in 70% of the cases. The height of the stratospheric aerosol layer found changed during the period of observation.

SUPPORTED BY U.S. Dept. of Energy

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, TERRESTRIAL ECOLOGY PROGRAM

R.G. Clements, University of Puerto Rico, Rio Piedras Campus, U.S. Dept. of Energy Center For Energy & Environmental Res., *Caparra Heights Station, San Juan, Puerto Rico* 00935 (000616)

The study will describe the interrelationships among climate, vegetation, soils, animals and man and their combined influence upon the hydrologic cycle of the drainage basin both at the local and regional level. Programmed research to be ordered by a five year comprehensive research plan to produce a data base and models where applicable, for environmental assessment and management. (1) Completion of Five Year Master Research Plan September 1976. (2) Interim reports on Soil, Plant, Animal and Limnological Surveys, January 1977. (3) Publication of "Succession and Regrowth following Irradiation in a Tropical Forest". (4) A ten year summary January 1977. (5) Initiation of the hydrology project of the Upper Espirito Santo Basin, 1978. (6) Establishment of drainage network throughout the drainage basin, 1977. (7) First approximation model of drainage basin, 1978.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

6.0002, ACCELERATION VERSUS ORTHOSTATIC TOLERANCE AFTER EXERCISE TRAINING IN MEN AND WOMEN

P.J. Brock, California State University & Colleges, California State University, Hayward Campus, School of Education, Dept. of Physical Education, *25800 Carlos Bee Blvd., Hayward, California* 94542 (NCA 2-290001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, THE EFFECT OF SPACE FLIGHT AS SIMULATED BY BED REST ON DRUG DISPOSITION
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, CARDIOVASCULAR EFFECT OF WEIGHTLESSNESS STUDIED BY TWO-DIMENSIONAL REAL-TIME ULTRASOUND
R.L. Popp, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NAS 9-16050)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0005, EVALUATION OF OSTEOCALCIN AS THE HOMEOSTATIC CONTROL MECHANISM FOR MINERALIZATION IN BONE
C.W. Asling, University of California, San Francisco Campus, School of Medicine, Dept. of Anatomy, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, INTERACTIONS BETWEEN OSMOLALITY AND BLOOD VOLUME IN THE CONTROL OF VASOPRESSIN SECRETION
D.J. Ramsay, University of California, San Francisco Campus, School of Medicine, Dept. of Physiology, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665006)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, EFFECTS OF ADRENERGIC AGENTS ON VASOPRESSIN SECRETION
I.A. Reid, University of California, San Francisco Campus, School of Medicine, Dept. of Physiology, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, GRADUATE STUDENT RESEARCHERS PROGRAM
I. Kuntz, University of California, San Francisco Campus, School of Pharmacy, Dept. of Pharmaceutical Chemistry, *551 Parnassus Ave., San Francisco, California* 94122 (NGT 05-029-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, PROLIFERATION AND DIFFERENTIATION OF PERIODONTAL LIGAMENT CELLS AND BONE CELLS DURING SIMULATED WEIGHTLESSNESS
W.E. Roberts, University of the Pacific, School of Dentistry, Dept. of Anatomy, *San Francisco, California* 94103 (NCA 2-588002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, LIFE SCIENCE FLIGHT EXPERIMENT
D.E. Parker, Miami University, School of Arts & Sciences, Dept. of Psychology, *Oxford, Ohio* 45056 (NAS 9-16049)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0011, LIFE SCIENCE FLIGHT EXPERIMENT - MOTION PERCEPTIONS IN ZERO GRAVITY
D.E. Parker, Miami University, School of Arts & Sciences, Dept. of Psychology, *Oxford, Ohio* 45056 (NAS 9-16051)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0012, HUMAN CAPABILITIES IN ACOUSTIC ENVIRONMENTS
C.S. Harris, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325120)

Air Force noise environments may affect motor performance, physiological function, thought processes and contribute to fatigue in personnel as well as affecting hearing. Special problems may arise with infrasonic, impulsive, and noncontinuous acoustic energy exposures. This effort is to define noise exposure conditions which degrade and threaten task accomplishment in order to specify safe operating parameters and eventually exposure guidelines. This effort will provide support for the whole body exposure effects standards sections in AFR 161-35.

The approach is to quantify cognitive and psychomotor performance on specific tasks in acoustic environs to such a degree that allowable exposure conditions can be adequately defined. The nature and difficulty of the performance tasks will be varied together with the frequency, duration and intensity of the acoustic stimulus in an effort to identify variables in the stimulus, task or subject that might result in reduced human capabilities. Post-exposure task performance will be examined for continuous and varying acoustic signals. A substantial technology base describing human performance in acoustic environs will be realized when these results are integrated with those from earlier efforts. This work unit is a continuation of work unit 72310903, Human Capabilities in Infrasound, and work unit 72310904, Acoustic Degradation of Human Capabilities. Semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the technical management review.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, EFFECT OF EXPOSURE TO MICROWAVES ON THE NEUROENDOCRINE STATUS OF THE RAT
R.D. Stith, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (DF054360; AFOSR-79-0041)

AF function - Air Force operating environments expose personnel to a wide variety of potential hazards which may limit or degrade man's ability to perform effectively. Current technology does not permit an adequate assessment of responses and tolerance to single, sequential or long-term exposure to these radiations. Fundamental data on the bioeffects of microwaves are necessary for the establishment and maintenance of adequate electromagnetic radiation safety criteria. Deficiency - very little is known about possible electromagnetic effects on biological systems exposed to athermal densities. In certain brain regions, microwave absorption and temperature effects may be 4 to 6 times higher than the mean temperature increase. No systematic, controlled investigations on a well-known chain of biochemical events in microwave-irradiated animals have been reported. Objective - the objective of the proposed research is to determine if whole body exposure to continuous wave or pulsed wave microwave radiation will result in quantifiable alterations in the neuroendocrine status of the brain. How research contributes - data obtained from these experiments will enable more accurate reappraisal of Air Force and occupational personnel exposure standards for microwave radiation. This research will support and contribute to research outlined in RO 1.9.1.2, electromagnetic radiation.

The objectives of this proposal will be achieved by exposing rats to various power densities of microwaves and then assaying hypothalamic and brain stem slices for norepinephrine, dopamine, serotonin, cyclic adenosine monophosphate (cAMP), cyclic guanosine monophosphate (cGMP), tryosine hydroxylase,

and tryptophan hydroxylase. In addition, blood samples will be assayed for the pituitary hormones ACTH, GH, and TSH.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, MITRAL VALVE MODEL
H.E. Whitmore, Texas A & M Research Foundation, *Faculty Exchange Box H, College Station, Texas* 77843 (DF324490; F33615-78-D-0629)

To develop mathematical algorithms which allow investigators to explore the correlations between mitral valve disorders and the development of heart disease in the USAF flying population.

The first phase of the task involves examining the literature and deriving possible mathematical models. At the end of the first phase, several possible models will be presented for consideration. The second and final phase involves implementing the selected model and verifying its feasibility with USAFSAM data related to mitral valves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0015, STUDY TO DEVELOP A FACTOR ANALYSIS STATISTICAL CAPABILITY FOR THE DESIGN PERFORMANCE LABORATORY
J.H. Stramler, Texas A & M University, College Station Campus, School of Science, Dept. of Biology, *College Station, Texas* 77843 (NAS 9-16073)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0016, AEROSPACE MEDICINE RESIDENCY PROGRAM
M.M. Key, University of Texas, Health Science Center at Dallas, Graduate School of Biomedical Sciences, *5323 Harry Hines Blvd., Dallas, Texas* 75235 (NGT 44-089-980)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0017, LIFE SCIENCE FLIGHT EXPERIMENT - INFLUENCE OF GRAVITY
M.P. Mlazsala, University of Washington, Graduate School, *Seattle, Washington* 98105 (NAS 9-16052)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, WORKSHOPS ON AUTOMATED DECISION MAKING AND PROBLEM SOLVING
E. Heer, University of Southern California, School of Engineering, Dept. of Industrial & Systems Engineering, *3551 University Ave., Los Angeles, California* 90007 (NCC 1-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0002, DATA FITTING
G.D. Taylor, Colorado State University, School of Natural Sciences, Dept. of Mathematics, *Fort Collins, Colorado* 80523 (DF055710; F49620-79-C-0124)

AF function - design of structural components for aerospace vehicles. Opportunity - to improve upon and expand the applicability of recent adaptive curve fitting schemes. Objective - to study and develop methods of fitting arbitrary data sets with computationally effective representations. How work contributes - results may hasten the development of data fitting computer software packages which would be useful for effective data reduction of massive data sets for computational manipulation or useful for data synthesis of sparse data sets for interpolation.

This effort will examine both one-dimensional and multi-dimensional data sets. (A) In the one-dimensional case, the study of recently developed adaptive curve fitting techniques and associated computer routines will continue. The main focus will be on the numerical testing and comparing of these routines. Also, the possibility of implementing these routines in a interactive mode will be examined. Finally, properties of a given data set that make one routine more effective than another will be identified and classified. (B) In the multi-dimensional case, adaptive piecewise polynomial surface fitting (2-D and higher-dimension) will be developed. The differential correction algorithm will be studied. Also, effective ways of selecting subsets of the original data set that exhibit the overall behavior of the data will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, STUDIES OF THE NUMERICAL SOLUTION OF ELLIPTIC PARABOLIC BOUNDARY VALUE PROBLEMS
Unknown, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (EY-76-S-05-3443)

The goal of the project is to understand the theoretical behavior of the numerical treatment of partial differential equations which could be organically placed in the general finite-element solver. The main emphasis will be given to problems which are important in applications but are not the standard ones, and to the question of how to effectively handle problems with nonsmooth coefficients and singular solutions. The problem of reliability and accuracy in the prescribed range of computational cost with self-adaptive approach will be focussed on also. The theoretical notion of a closure of the entire numerical process will be applied to design and asymptotically optimal approach. The theoretical investigations will be in close conjunction with practical computations.

RESULTS: Results in the proposed field have been obtained by the investigators and published in the form of various reports and publications.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

7.0004, OPERATION OF A COMPUTER CENTER AND RESEARCH IN PLASMA PHYSICS
Unknown, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (EY-76-C-02-3077)

The main thrust of the Laboratory is in numerical analysis and partial differential equations with emphasis on computational fluid dynamics. Topical areas of endeavor are as follows: Development of shockless airfoil codes for industry. The Laboratory has underway a joint project with Pratt-Whitney Aircraft to test compressor airfoils designed at N.Y.U. Computational magnetohydrodynamics in three dimensions, such as the modeling of equilibrium and stability of a plasma in toroidal geometry. One objective is to bring the high beta stellarator into a range of operation competitive with current Tokamak research. Flow problems relevant to the upgrading of compressors used in gaseous diffusion process for the enrichment of uranium. Elastodynamic and fracture problems related to nuclear shots to stimulate the flow of natural gas from relatively impermeable strata by fracturing the rock. Computer modeling of reacting chemical systems for new and more efficient ways of utilizing chemical fuels. Application of simulation methods to the study of time evolution of quenched binary alloys, to gain understanding of the formation of alloys to predict their strengths and behavior with respect to radiation damage. The environmental impact of a power station in raising the temperature of an adjacent flowing river, particularly when the river flow is controlled by the operation of a dam. Laser fusion studies with the goal of obtaining energy from controlled thermonuclear reactions driven by high power lasers. Theoretical and numerical methods used to

study the reflooding problem in a loss of coolant accident in reactors. Through participation in the ARPANET, the Laboratory has access to very fast and powerful computers that permit effective handling of the multidimensional problems that arise in energy research. In computer science, the Laboratory develops compilers and high level programming languages.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

7.0005, OPTIMAL MULTICROP SAMPLING AND AGGREGATION PROCEDURES DEVELOPMENT
H.O. Hartley, Duke University, Trinity College of Arts & Sciences, Dept. of Mathematics, *Durham, North Carolina* 27706 (NAS 9-16020)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

7.0006, ANALYSIS OF COMPUTATIONAL METHODS FOR NONLINEAR PARABOLIC DIFFERENTIAL SYSTEMS
R.L. Brown, University of Virginia, School of Engineering & Applied Science, Dept. of Applied Mathematics & Computer Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DF054980; AFOSR-79-0024)

AF function - the design of reentry vehicles. Deficiency - efficient and accurate numerical schemes are needed to solve associated nonlinear parabolic differential equations. Objective - to reduce the computing time for solving parabolic equations in general with the flow on a cone problem being used to motivate and verify such computational improvements. How work contributes - algorithms developed may be used for the design of reentry and aerospace vehicles.

1. The effect on maximum and minimum stable stepsize in the x direction of using finite element representation of the boundary value problem will be investigated. 2. The generation of large algebraic amplification matrices involved in stability analysis of multistep methods will be studied. 3. The feasibility of using general purpose initial value problem integration packages will be studied. 4. The nonlinear stability region of the flow on a cone problem will be found using software currently being developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, STUDY OF HIGH-SPEED COMPLEX NUMBER ALGORITHMS
R. Heisler, Walla Walla College, Graduate School, Dept. of Mathematics, *College Place, Washington* 99324 (NAS 5-25994)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, CHARACTERIZATION OF ADVANCED ELECTRIC PROPULSION SYSTEMS
P.K. Ray, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NAG 3-76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0002, ELDOR INVESTIGATIONS OF RADIATION PROCESSES
Unknown, University of Alabama, Graduate School, *P.O. Box 2846, University, Alabama* 35486 (EY-76-S-05-4062)

The objective of the present research is to examine the role of the host matrix as a function of temperature in determining the type and yield of radicals produced by X-irradiation of a crystalline or glass material using electron-electron double resonance (ELDOR), electron-nuclear double resonance (ENDOR), electron spin resonance (ESR) and heavy atom substitution techniques. After many years of research on the effects of radiation on crystalline materials, it is still difficult to predict from the thermal history, nature of radiation, crystal structure or form of the parent molecule what radical species will be stable at any given temperature. However, an examination of the ELDOR spectra of an irradiated substance results in a partial or complete measure of the relaxation mechanisms which, in turn, are related to the host matrix itself. The host matrix can be changed slightly by using the heavy atom substitution technique, by using different methods of crystallization, and by including radical precursors in clathrates, permitting a study of the relation among host matrix variation, radical yield and relaxation parameters.

RESULTS: ESR investigations carried out on single crystals of irradiated fluoro, chloro and bromo derivatives of acetamide and acetic acid have shown that a large matrix effect is present which is dependent upon the leaving group size, crystal structure and degree of crystallization. ELDOR measurements between 5 degrees K and 370 degrees K have shown a large variation in ELDOR intensity dependent on intramolecular motion, quadrupole coupling, p-orbital anisotropy, spin diffusion and tunnelling rotation. Forbidden ESR lines overlapped by intense ESR lines, ESR lines too broad to detect, ENDOR transitions and radical cluster have been studied by ELDOR.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0003, CORRELATIONS BETWEEN AURORAL FEATURES AND LOW-ENERGY ION CHARACTERISTICS IN THE MAGNETOSPHERE
J.L. Horwitz, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (NGT 01-002-082)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0004, STUDIES ON LASERS AND LASER DEVICES
S.E. Harris, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NAG 2-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, A THREE-DIMENSIONAL MODEL OF BOW SHOCK LOCATION AND MOTION
R.E. Holzer, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0006, THE MEASUREMENT OF TOTAL CROSS SECTIONS AND EQUILIBRIUM FRACTIONS OF 10 TO 200 KEV D AND D2 POSITIVE IONS IN COLLISION WITH METAL VAPORS
T.J. Morgan, Wesleyan University, Graduate School, Dept. of Physics, *Middletown, Connecticut* 06457 (EY-76-S-02-4022)

PURPOSE: Measure cross-section for formation of negative deuterium ions (D-minus) by charge exchange of positive deuterium ions (D-plus) and dissociation of positive molecular deuterium ions (D-plus). Also measure equilibrium negative ion fractions. These data are required for understanding and design of negative ion type neutral beam injection systems. APPROACH: We are measuring the yields of D-plus, D-minus, and D as functions of target thickness. From the slope of the curve of yield versus thickness we obtain the cross-sections. As the target thickness is increased, the yields will eventually become constant. These values are the equilibrium yields. The initial D-plus ions are produced in an RF source, accelerated and momentum analyzed. They pass through a metal vapor target cell designed to reach temperatures near 1000 degrees C. The analysis section contains electrostatic separation plates,

three Faraday cups, and a secondary electron emission detector. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy

8.0007, GRADUATE STUDENT RESEARCHERS PROGRAM

C.W. Wernitz, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (NGT 09-005-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0008, QUANTITATIVE ANALYSIS OF SOLUTE SEGREGATION IN ALLOYS BY TRANSMISSION ELECTRON MICROSCOPY

Unknown, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (EY-76-S-05-4311)

OBJECTIVES: 1. To measure experimentally second phase nuclei or embryonic second phase particles at crystal defects. 2. To characterize very small crystal defects (less than or equal to 100 A) such as dislocation loops or voids.

Segregation of solute atoms, impurities, or point defects into clusters or onto existing crystal defects is a vital first step in the development of second phase precipitates or in the development of complex microstructures resulting from radiation damage. Such objects are beyond the direct analytical capabilities of even the best electron microscope. However, computer simulation of electron microscope images can be used to interpret highly complex strain contrast images provided: 1) the experimental conditions are well regulated and 2) the computer modeling conditions are sufficiently realistic. Both of these conditions have been shown to be met for a wide variety of complex linear and planar defects and for some point defect images. In addition, simulation experiments can be used to test complex imaging criteria and to suggest the optimum experimental conditions for the electron microscope.

Our test specimens have included θ' precipitates in Al-Cu alloys, oxide platelets in silicon, and quenched-in vacancies in pure Al. We propose next to use HVEM in situ irradiation of several BCC and FCC foils to fully test our catalog of computed dislocation loop images. If successful, these methods may be used to study the mechanisms of loop formation, the size distribution of defects, and the superposition of precipitates on loops and voids.

RESULTS: Development of rapid, general computer simulation program to match TEM images of dislocations, planar faults, dislocation loops and other small three dimensional defects, and combinations thereof. Calculated catalog of possible images for loops in FCC and BCC structures (isotropic, infinitesimal approximation). Applications to alloys (Al-Cu and Nibase), oxidation defects in silicon, quenched-in defects in Al, irradiated defects in W.

SUPPORTED BY U.S. Dept. of Energy

8.0009, PHOTOELECTRIC EMISSION FROM THIN FILMS IN THE VACUUM ULTRAVIOLET REGION

W. Pong, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Physics, *2444 Dole St., Honolulu, Hawaii* 96822 (EY-76-S-03-0235-009)

This project is concerned with the fundamental and applied research on materials of interest to the energy research and development program. The experimental technique involves the application of vacuum ultraviolet radiation to investigate the optical and electronic properties of solid films and surfaces. Materials of interest in our current studies are those which are suitable for: solar photovoltaic energy conversion; windows and reflectors for high-power laser beams; solar energy collectors.

SUPPORTED BY U.S. Dept. of Energy

8.0010, BASIC STUDIES OF ATOMIC DYNAMICS

Unknown, University of Chicago, Graduate School, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EY-76-S-02-1674)

This continuing project tries to unravel the correlations between the motions of different particles and the energy exchanges between different types of motion in electron collision and photoabsorption processes. The next major task which is contemplated is to concentrate effort toward achieving two distinct substantial advances on the theory of joint excitation and correlations of an electron pair. Other sustained efforts will be directed to the application of atomic points of view to solid-state problems and to the unraveling of the mechanism of atomic orientation by collision.

RESULTS: Since October 1, 1976 seven papers published or in the process of publication are identified as COO-1674-123, 124, 125, 130, 131, 132, and 136. Numbers 126, 127, 128, 129, are abstracts of papers presented at various conferences. Numbers 133, 134, and 135, are talks presented at various conferences and are to appear in print.

SUPPORTED BY U.S. Dept. of Energy

8.0011, THE STUDY OF PHONONS IN AMORPHOUS AND CRYSTALLINE SOLIDS UTILIZING THE APPLICATION OF LASER RAMAN SPECTROSCOPY

Unknown, University of Chicago, Graduate School, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EY-76-S-02-2126)

Amorphous diamond films, which are superhard and exhibit the physical characteristics of crystalline diamond, will be studied with optical techniques to ascertain their structural characteristics and the influence of those characteristics on physical properties.

We will attempt to intercalate the graphitic form of amorphous carbon films and vitreous carbon with the donor alkali metals, K, Rb, and Cs. Successful intercalation should yield information on the structure of disordered carbon as well as drastically alter the electronic properties of the material. Sufficient intercalation may result in a new type of metallic glass. We will also endeavor to intercalate the acceptor compounds, sulfuric and nitric acid. Successful intercalation will be detected from physical, electrical, and optical changes in the film.

The low-frequency Raman spectrum and Brillouin spectrum of amorphous arsenic will be studied to detect excess scattering from non-Debye-like excitations. Such excitations have been associated with the anomalous linear term in the specific heat exhibited by all glasses studied to date except amorphous arsenic.

An effort will be made to observe irreversible and reversible photostructural and thermostructural changes in evaporated bulk As2O3 glass. The optical effects associated with such changes provide the capacity for high-density rapid information storage. The atomic configurations associated with the changes will be studied using Raman, infrared, Brillouin, and X-ray techniques.

The two-dimensional order disorder transformation in graphite intercalated to stage 2 and higher with alkali metal atoms will be studied with X-ray and optical techniques. The temperature dependence of the Raman continuum in stage 1, C8K, C8Rb, and C8K, will be carefully studied as will the spectra of C6M, M equals Li, Sr, Ca, Ba to distinguish between the nearest layer model and zone folding model for vibrational excitations of intercalated graphite. An X-ray and Raman study of graphite intercalated with alkali metal ammonia solutions will be undertaken. The inversion splitting of the nu 2(A1) band of NH3 will be used to probe the graphite interlayer interaction.

Crystals of NaxWO3 0 less than or equal to x less than or equal to 0.5 will be prepared, characterized, and studied with polarized temperature-dependent Raman spectroscopy. (Text abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0012, FIN STABILIZATION OF MAGNETICALLY CONFINED PLASMAS

V.H. Weston, Purdue Research Foundation, *West Lafayette, Indiana* 47907 (EY-76-S-02-4125)

It is proposed to continue the study of different outer conducting configurations on the stability of magnetically confined plasmas, with emphasis on fins or conducting surface lying on radial planes of field lines exterior to a cylindrical circular plasma. Multiple interaction terms between fins will be taken

into account and the extension from the small pitch case to the large pitch case will be considered. The effects of different outer conductor configurations on the stability of the various modes will be ascertained by comparing the corresponding minimum form of the perturbed vacuum field portion of the energy integrals.

RESULTS: A comparison of the effect of different configurations of the outer conducting surface on the stability of a cylindrical circular plasma of radius A and length L was made. The usual surface perturbation of the form eikz plus or minus in theta, k equals approximately 0 are treated. 'Fins' of zero thickness have no effect on the n equals 0 mode. However they do tend to stabilize the important n equals 1 mode. Neglecting multiple interaction terms, preliminary results indicated that four fins in the planes theta equals 0, plus or minus pi over 2 and pi with a/c equals .9 where c is distance of edge of fin to center of plasma have the same stabilization effect on the n equals 1 mode as the concentric outer cylinder of radius b where a/b equals .45.

SUPPORTED BY U.S. Dept. of Energy

8.0013, OPTICAL PROPERTIES OF SEMICONDUCTORS, MAGNETIC SEMICONDUCTORS AND FAR-INFRARED EMISSION FROM SEMICONDUCTORS

H.Y. Fan, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-24306)

Experimental studies of magnetic semiconductors and far-infrared emission from semiconductors doped with impurities will be carried out as an extension of research supported by DMR-7511178. The one-magnon and two-magnon Raman scattering processes have been observed and investigated in manganese oxide, cobalt oxide and cubic manganese sulfide. The change in the Raman scattering of phonons associated with the structural phase transition in di-vanadium trioxide has also been observed. Careful spectroscopic studies of the Raman scattering in di-vanadium trioxide will be carried out to determine the effects of various external conditions, such as strong magnetic fields, on the metal-insulator, structural and antiferromagnetic phase transitions in this material. Also, the studies of far-infrared emission from semiconductors containing shallow impurity levels will be continued. This effort will be directed toward obtaining stimulated emission. Experiments to determine the level of stimulation as a function of wavelength and to observe spatial coherence of the emission will be carried out.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, ATOMIC PHYSICS WITH HIGHLY IONIZED IONS

P. Richard, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (EY-76-S-02-2753)

Atomic physics with energetic highly ionized ions will be performed under five programs to study (1) the production of X-rays in solid media, (2) the processes of electron loss and gain in gas media, (3) X-ray spectroscopy in ion-atom collisions, (4) atomic collisions theory and (5) applications and developments with heavy ion beams. The process of electron capture will be studied experimentally and theoretically under topics 1, 2, 3, and 4. Alignment of atomic states will be investigated through the observation of target and projectile radiation. The target thickness dependence of X-ray yields will be studied to obtain target and projectile vacancy production and vacancy quenching cross sections in solids. X-ray spectroscopy of heavy ions will be initiated for X-rays with energy approximately greater than 4 keV using a new Cauchois spectrometer. Impact parameter dependences of cross sections will be extended to heavier ion partners.

RESULTS: During the 12-month period from 1 August 1976 to 31 July 1977, 19 scientific papers were published, 10 scientific papers are in the process of publication and 23 contributed and invited papers were presented on a wide range of experimental and theoretical analysis of ion-atom interactions at high energies.

SUPPORTED BY U.S. Dept. of Energy

8.0015, ELECTRON EXCITATION CROSS-SECTIONS FOR MULTIPLY CHARGED IONS

J. Callaway, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (EY-76-S-05-4881)

The work proposed is the continuation of theoretical calculations of the cross-sections for excitation of positive ions of the lithium and helium isoelectronic sequences by electron impact. The energy range considered is from the threshold for excitation to approximately 4 times the ionization energy. The calculations will be based on a close coupling expansion with exchange. Different methods of solution of the coupled integro-differential equations including the R-matrix method, the matrix variational method, and the non-iterative integral equation method will be investigated for speed and accuracy. The energy range studied is one in which simple approximations of the Coulomb Born type are not valid. The contribution of Rydberg series of resonances below some excitation thresholds will be determined. Extrapolation of excitation cross-sections along helium-isoelectronic sequence will be made. Consideration of relativistic effects in both the structure of the ion and in the description of scattering as the nuclear charge increases will be made so that we can determine excitation cross-sections for highly stripped impurity ions in high temperature plasmas of interest in thermonuclear reactors.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0016, A STUDY OF THE TWO-BODY DISSOCIATION OF LIGHT NUCLEI IN NUCLEAR FIELDS

R.W. Huggett, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (EY-76-S-05-4699)

The objective of the experiment is to measure the cross sections for the dissociation of light nuclei into two-body nuclear final states during peripheral nuclear collisions. The cross section for dissociation into a specific two-body nuclear final state is proportional to the square of the probability that the projectile nucleus existed as a configuration of the two final-state nuclei at the time of collision. The results will be significant because there has been increasing speculation recently concerning the existence of short-lived conglomerates of nucleons called 'clusters' within a parent nucleus.

The experiment will employ beams of 20/10 Ne, 16/8 O, 14/7 N, 12/6 C, 10/5 B, 6/3 Li, 4/2 He, and 2/1 H ions.

The kinetic energy of the heavy ions will be 2.1 GeV per nucleon. Those interactions in which the projectile nucleus dissociates into two fragments within the target will be selected electronically and recorded on magnetic tape for analysis.

The measured quantities will include the trajectories and charges of the incident nucleus and both final-state nuclei. The momenta of both final-state nuclei will be deduced from their bending angles in a magnetic field of 38 kG-m. Wire spark chambers with magnetostrictive readout will be used to encode the positions of projectile and final-state nuclei. Charges will be measured in scintillation counter hodoscopes.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0017, THEORETICAL STUDIES OF HIGHLY IONIZED SPECIES

Unknown, Harvard University, Cambridge Campus, Graduate School, *Cambridge Station, Cambridge, Massachusetts* 02138 (Y-76-S-02-2887)

Applications of the relativistic random phase approximation will be carried out for the neon isoelectronic sequence, to inner shell ionization processes, and to electron scattering by elements of high nuclear charge. Non-radiative charge transfer processes will be studied. Dissociative recombination in low temperature

plasmas and dielectronic recombination in high temperature plasmas will be considered.

Model potential methods will be used to study the copper and zinc isoelectronic sequences, as well as multiphoton processes with weak and strong electromagnetic fields.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0018, ELECTRONIC RELAXATION PROCESSES IN POLYATOMIC MOLECULES
Unknown, Wayne State University, Graduate School, *Cass & Antoinette Aves., Detroit, Michigan* 48202 (EY-76-S-02-2192)

The main thrust of this proposal is to investigate isotope effect on electronic relaxation as a probe of detailed mechanisms of radiationless processes. Three programs are presented in the proposal.

The first program explores the isotope effects on both the overall and the spin sublevel decay rates of the lowest triplet state (T1), and their dependence on the T1-T2 vibronic coupling. Much of the experiments are designed to test the specific theoretical predictions based on the important working hypothesis that the vibronic coupling between n pi* and pi pi* states leads to a very efficient radiationless transition from the lower of the two vibronically coupled states (proximity effect). The study represents the most stringent test of the proximity effect that has been carried out to date.

The second program involves studies of isotope, viscosity, and temperature effects on the formation and decay dynamics of excimers and exciplexes. The specific question we address is the role of the inter-ring stretching vibration in radiationless transitions of these systems. The results should provide the first step toward understanding the little known radiationless process in composite molecular systems. Supersonic molecular beam laser spectroscopy of excimers is also proposed to complement these photophysical studies.

Finally, in the third program, we propose to examine the lifetimes of triplet yields triplet fluorescence and their deuterium isotope effects in anthracene and its derivatives. These studies will be combined with the spectroscopic investigations of lower-lying triplet states to gain a detailed understanding of the mechanism of singlet yields triplet intersystem crossing in aromatic hydrocarbons.

RESULTS: Experimental and theoretical studies of isotopes and substituent effects on T1 radiationless decay rates have been carried out as a test of the working hypothesis that vibronic coupling between n pi* and pi pi* states leads to very efficient radiationless decay from the lower of the two vibronically coupled pair (proximity effect). In addition to providing general support to this hypothesis, the results indicate that isotope effects on spin sublevel decay rates are needed for a stringent test of the proximity effect.

The radiationless decay rates of the 3B1g state of anthracene and its derivatives have been deduced. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0019, EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS EMPHASIZING RESEARCH LIQUID HELIUM AND OTHER MATERIALS
Unknown, University of Minnesota, Minneapolis Campus, Graduate School, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (EY-76-S-02-1569)

The proposed research consists of studies of superconductivity, magnetism at low temperature, and of superfluidity in liquid helium.

The research on superconductivity is aimed at understanding the dynamics of the superconducting order parameter and the fluctuations associated with the superconducting-to-normal transition. The work proposed includes measurements of the pair-field susceptibility in films with magnetic impurities and in current-carrying films, with particular attention being paid to the behavior of the "longitudinal" and "transverse" modes of the order parameter. Also included are measurements of the specific heats of high-Tc Nb3Ge films. In addition, the competition between superconductivity and the metal-nonmetal transition in films of HgxXe1-x will be investigated.

The research on magnetism will employ nuclear orientation and SQUID magnetometry to study magnetization of very dilute alloys of manganese in copper, silver, and gold at temperatures in the range from 1 to 100 mK in applied fields from 10 G to 80 kG. Studies of the properties of hyperfine-enhanced nuclear collants and a search for collants capable of achieving temperatures below 1mK will be continued. A collaborative study of the properties of paramagnetic materials for magnetic refrigerators will be undertaken in the temperature range from 1 to 100 K in fields from 0 to 80 kG.

The research on superfluidity involves both pure 4He and 3He/4He mixtures and concerns the dynamics of superfluid flow. It is proposed to carry out measurements of the superfluid density of 3He/4He mixtures in fine regular pores using a Helmholtz resonator technique, extending previous measurements on pure 4He. A search for an AC Josephson effect in pure 4He will be undertaken using an apparatus conceived in analogy to an RF SQUID. In addition, measurements of the superfluid circulation around a fine wire in pure 4He will be continued with wires less than or equal to 25 microns in diameter to probe the quantization of circulation hypothesis.

RESULTS: Measurements of the superconducting pair-field susceptibility have been started in Er-doped Al films and on current-carrying films of pure Al. A technique to measure the heat capacities of thin superconducting films has been developed. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0020, OBSERVATION OF LUMINESCENT SPECTRA IN LOW ENERGY ION-NEUTRAL COLLISIONS
Unknown, University of Missouri, St. Louis Campus, Graduate School, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (EY-76-S-02-2718)

The research is directed toward determination of the energy partitioning among internal energy states of the product of low-energy (1 to 500 eV) positive ion-neutral molecule collisions by observation of luminescence from decay of these excited products. Previous studies of kinematics and dynamics of reactive potential energy of exothermic systems showed that the energy can be efficiently converted to internal energy of the collision products. The present research is designed to yield precise internal state distributions in the collision products. The apparatus provides a mass-selected ion beam which is directed into a collision cell containing neutral gas at low pressure. Photons emerging from the collision cell are analyzed and counted to yield the collision-produced spectrum. Since the experiments are performed under single-collision conditions, details of the energy partitioning on a molecular level are obtained.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0021, A STUDY OF THE PHOTOIONIZATION PROCESSES OF ATOMS
J.A. Samson, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (EY-76-S-02-2892)

The experimental and theoretical study of atomic photoionization processes has advanced rapidly in the past decade so that both experimental and theoretical total photoionization cross sections in the vacuum ultraviolet region, at least for the rare gases, are possible with accuracies of plus or minus 10%. This accuracy makes possible the major objective of the proposed experimental and theoretical research program, which is to unravel the effects of electron correlation and of spin-orbit interaction on atomic photoionization processes. While the proposed research nevertheless requires the refinement and advancement of current techniques, the possibility of combined theoretical and experimental attack on these new research problems is a distinct benefit to both theory and experiment and increases the probability of obtaining significant results. Specifically it is proposed to measure and/or calculate total and partial photoionization cross sections, photoelectron branching ratios and angular distributions, and multiple ionization cross sections either over an energy region of a few Rydbergs above threshold or over the narrow energy region of an autoionizing resonance. These studies will be carried out both for the rare gases as well as for

less studied atoms, in particular open-shell atoms. Among the atoms for which experimental work is proposed are the rare gases, metal vapors, and O. Among the atoms for which theoretical work is proposed are Al, Cl, and Xe. In addition, photoionization of hydrogen-like atoms in high magnetic fields will be studied theoretically.

RESULTS: Random phase approximation calculations for photoionization of an open-shell atom have been carried out for atomic chlorine. Virtual double excitations in the ground state, which influence rare gas photoabsorption cross sections significantly, do not play as important a role in atomic chlorine due to an averaging out of these effects among many final state channels. Photoelectron angular distributions have been calculated for the outer (open) shells of the halogens and the chalcogens and it is found that anisotropic electron-ion interactions are strongest in the second row of the periodic table. Experimentally, a rotatable vacuum UV polarizer and a fixed electron energy analyzer have been designed and built to measure the photoelectron angular distribution of atomic oxygen at 584 Å; work is continuing. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0022, THEORY OF ELECTRON-PHONON SCATTERING EFFECTS IN METALS
W.E. Lawrence, Dartmouth College, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 833, Hanover, New Hampshire* 03755 (EY-76-S-02-2315)

Studies of quasiparticle lifetimes and transport relaxation times will be continued for the noble and polyvalent metals. A method for accurate calculation of the transport times at low temperatures will be developed, and applied in specific instances. The variational method will be applied to a number of non-equilibrium phenomena in superconductors. An attempt to clarify the relationships between superconducting and normal-phase lifetimes will be made. Electron-electron scattering will be studied further, with attempt to account for relaxation time anisotropy and the resulting interference with other scattering mechanisms.

RESULTS: Diffusion model derived and formalized; electrical and thermal DMR calculated in detail for potassium and copper, variational convergence tested; quasiparticle properties calculated for aluminium, method developed for low temperature lifetime calculations; superconducting order parameter relaxation times related to anisotropic quasiparticle lifetime of normal phase, detailed calculation done for aluminium; electron-electron effects calculated for noble metals, reviewed for simple metals.

SUPPORTED BY U.S. Dept. of Energy

8.0023, THEORETICAL PLASMA PHYSICS RESEARCH
M.N. Rosenbluth, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (EY-76-S-02-3237)

Work is proposed on the following topics: 1. Nonlinear Tearing Modes in Tokamaks; 2. Ballooning modes; 3. Effects of Alpha Particles; 4. Drift Tearing Modes and Stochastic Magnetic Fields; 5. Electron Cooling of Ion Beams; 6. Ion Ring Stability; 7. Shear Alfven Modes in High Beta Mirrors; 8. Tormac Research; 9. Ruelle-Takens Attractor Theory; 10. Drift Convective Cells.

SUPPORTED BY U.S. Dept. of Energy

8.0024, EXPERIMENTAL AND THEORETICAL STUDIES ON THE PHYSICS OF BIOLOGICAL MOLECULES
J.J. Hopfield, Princeton University, Graduate School, Dept. of Physics, *205 Nassau Hall, Princeton, New Jersey* 08540 (DMR78-05916)

This research is aimed at an understanding of how biological molecules, assemblies, and systems operate from a physical and quantitative viewpoint. Currently under study are electron transfer proteins and assemblies (where an understanding of the mechanism of electron transfer and its relation to molecular structure and environment are sought), hemoglobin (where the mechanism by which the global structure affects local chemical properties is investigated), and accuracy problems and mechanisms in biosynthesis. The work is a closely integrated combination of experiment and theory, as in the electron transfer studies. The theoretical description of vibronically coupled electron tunneling transfer is now being tested by studying a charge transfer band described by the theory. The band is three orders of magnitude weaker than any previously studied. This experimental study is capable of providing a complete test of the concepts, constructs, and parameters of the theory. With an understanding of the mechanism of reaction, an approach to understanding some of the physical problems of photosynthesis and oxidative phosphorylation can begin. The chief experimental tool is very sensitive. modulation spectroscopy.

This is a continuation of research supported under DMR 75-14264.

This is the first year of a three-year continuing grant.

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8.0025, THEORETICAL HIGH-ENERGY PHYSICS
T.D. Lee, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (EY-76-C-02-2271)

The investigations of the Columbia Theoretical Group have been and will continue to be concerned with all theoretical aspects of high-energy physics. Our main efforts will lie in the areas of particle physics, field theory and symmetry principles, including their extensions to related problems in atomic and nuclear physics, astrophysics and statistical mechanics. We shall continue our close relationships with groups carrying out experiments at Nevis, Brookhaven, SLAC, Argonne, Berkeley, NAL and CERN. We shall attempt to maintain a broad view of the prospects of high-energy physics which may be useful in the future determination of national scientific policy.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0026, HIGH BETA PLASMA RESEARCH
C. Chu, Columbia University, School of Engineering & Applied Science, Dept. of Applied Physics & Nuclear Engineering, *Broadway & W. 116th St., New York, New York* 10027 (EY-76-S-02-2456)

We are performing experiments studying the equilibrium stability of plasma in a modest size rectangular cross section high-beta Tokamak. Theoretical and computational high beta plasma studies closely related to our experiments are also being done by us. We are studying plasma-wall interactions and the metallurgical effects of deuterium-plasma bombardment of first wall materials.

SUPPORTED BY U.S. Dept. of Energy

8.0027, INFLUENCE OF GRAIN BOUNDARIES ON ELECTRICAL TRANSPORT PROPERTIES OF POLYCRYSTALLINE SI FILMS
D.G. Ast, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (EY-76-S-02-2899)

To continue work on preparation of controlled grain boundary structures in Si. To characterize the structure of these boundaries by high resolution transmission electron microscopy. To investigate the electrical properties of these boundaries by conventional electrical measurements.

RESULTS: A variety of twist and tilt boundaries have been fabricated and their structure has been analyzed. The electrical activity of microtwins (frequently mistaken for stacking faults) has been investigated.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0028, SPIN RESONANCE AND THE STUDY OF SOLIDS AND LIQUIDS
R.M. Cotts, Cornell University, Ithaca Campus, School of Physical Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR77-24561)

This is a continuation of research previously supported under DMR 73-07521.

A series of experiments which will utilize nuclear magnetic resonance to investigate the details of diffusive motion of hydrogen atoms in transition metal-hydrogen systems will be carried out. The results of two separate experiments (temperature dependence of relaxation times and pulsed gradient spin echo techniques) will be combined to determine the diffusion step length of hydrogen atoms in titanium hydride. A new multiple pulse technique for measuring the hydrogen diffusion coefficient will be applied to vanadium and tantalum hydrides. The motion of hydrogen in the low temperature phases of Group VB metals will also be studied using measurements of the relaxation times. The purpose of the low temperature experiment is to determine changes in mobility with change in phase and to search for low temperature deviation which would indicate tunneling modes for hydrogen.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, INVESTIGATE TRAVELING IONOSPHERIC DISTURBANCES IN EARTH'S IONOSPHERE BY ANALYSIS OF SATELLITE TO SATELLITE DIFFERENTIAL DOPPLER DATA AVAILABLE

S.H. Gross, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Electrical Engineering, *333 Jay St., Brooklyn, New York* 11201 (NAGW 51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0030, NUCLEAR STRUCTURE THEORY

Unknown, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (EY-76-S-02-2171)

Our research program is, broadly, the development and application of nuclear theory, including nuclear structure and nuclear reactions. This involves the development of new general theoretical methods, as well as the detailed examination of particular nuclei or nuclear reactions. We are working in the following areas: 1) Shell-model spectroscopy. Theory of the effective interaction and other aspects of the shell-model from the many-body point of view. 2) Spectral distribution methods in complex nuclei, including level densities and strength distribution, as well as general studies of nuclear symmetries and statistical behavior. 3) Interactions of high-energy particles with nuclei, including the theory of nuclear reactions of elementary particles, as well as nuclear-structure aspects of particle-removal reactions.

SUPPORTED BY U.S. Dept. of Energy

8.0031, DIFFUSIONAL CREEP OF MULTICOMPONENT SYSTEMS

Unknown, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (EY-76-S-02-2296)

The successful completion of impression creep studies on Cu-Ni single crystals of all compositions and on beta-Tin single crystals of 3 orientations proved to us once more that impression creep can be a convenient substitute for conventional creep testing. The data obtained on these crystals are actually better than literature values because of the elimination of sample-to-sample variations. In the next period we propose to finish the Bi-Sb system using the apparatus already built for beta-Tin studies.

In addition we propose to study micro-impression elasticity to measure local elastic modulus using the same indentation technique and, at the same time, to extend impression creep studies to low temperatures. However, most important of all, we propose to study creep mechanisms by selective laser excitation. A tunable laser will be used to sort out different deformation of diffusive mechanisms in both crystalline and amorphous solids.

RESULTS: Two manuscripts are in preparation: 1. Impression Creep of Cu-Ni Single Crystals; 2. Impression Creep of beta-Tin Single Crystals.

SUPPORTED BY U.S. Dept. of Energy

8.0032, PLANAR MULTIJUNCTION HIGH VOLTAGE SOLAR CELLS

V.J. Kapoor, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NAG 3-80)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0033, NEUTRON STUDIES OF LIGHT NUCLEI

Unknown, Ohio University, Athens Campus, Graduate School, *Athens, Ohio* 45701 (EY-76-S-02-2490)

The structure of light nuclei will be studied by means of their interaction with neutrons. The experimental program will include the elastic and inelastic scattering for neutrons interacting with 6Li, 7Li, 10B, 11B, 12C and 13C measured at the Ohio University Tandem Accelerator Laboratory by use of sub-nanosecond pulsed beams and time-of-flight methods. These results will be analyzed via the R-matrix formalism for comparison to theoretical model predictions. This research will enable us to improve our knowledge of the structure of light nuclei and develop further the various theoretical models for nuclear structure and nuclear reactions. These nuclei have particularly important applications in fusion reactor programs as well as in the standards used for measurement of cross sections and neutron fluxes.

RESULTS: A large set of data has been measured for the elastic and some inelastic scattering cross sections for neutrons scattered from 6Li, 7Li, 10B, 11B and 12C between 4 MeV and 8 MeV for angles from 20 degrees to 160 degrees using the Ohio University Tandem Accelerator. An R-matrix calculation has extracted several properties for the compound nuclei.

SUPPORTED BY U.S. Dept. of Energy

8.0034, ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES

G.P. Summers, Oklahoma State University, Agricultural Experiment Station, Dept. of Physics, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

Optical absorption bands have been found in 'as grown' Al2O3 which are similar to bands found in particle irradiated material. In particular, a band at 6 eV which has been assigned to an O2-vacancy is found to anneal at 1250 degrees C in 'as grown' material compared to 600 degrees C in particle irradiated material.

SUPPORTED BY Oklahoma State Government

8.0035, ELECTRONIC STRUCTURES OF DEFECTS IN OXIDES

Unknown, Oklahoma State University, Graduate School, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (EY-76-S-05-4837)

The object of the proposed research is to determine the production and trapping of electric charge within the oxides alpha-Al2O3, CaO, SrO, ZnO and spinel, which can be excited by light (photoconductivity) both before and after irradiation of the materials by gamma-rays, high-energy electrons, protons, or neutrons. The purpose is to detemine as well as possible the electronic structure of defects produced in the materials as a result of the irradiation. In particular we are concerned with radiation-induced anion vacancies in these materials. Additional information will be obtained by measuring photoluminescence and fluorescence lifetimes associated with the radiation-induced defects. The measurements are composed closely with recent calculations of the electronic structure of the defects. We are also concerned with determining the role played by ion group impurities in controlling charge transfer in alpha-Al2O3. Also, we compare results of radiation-induced defects with those produced in non-stoichiometric oxides, in particular CaO.

RESULTS: Photoconductivity has been detected from radiation-induced anion vacancies in SrO of CaO. The thermal ac-

tivation energy for the one electron center is 0.12 eV and 0.24 eV in SrO and CaO, respectively. In SrO the charge is released into the conduction band or fluorescence occurs from a long-lived electronic state (approximately 0.42 microseconds). Photoconductivity measurements indicate that a radiation-induced optical band at 204 nm in alpha-Al2O3 is a composite band.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0036, A STUDY OF FLOW AND LOSS PROCESSES AT THE ENDS OF A LINEAR THETA PINCH
T.M. York, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (EY-76-S-02-4020)

Purpose: investigate the physics of end loss from a theta pinch including mechanisms governing the loss and methods of inhibiting loss to improve confinement. Approach: Construct a 50 cm pinch apparatus with a 10 cm discharge coil. Measure the loss rate of plasma within the pinch coil, and correlate measurements with properties (pressure, density and temperature) near and at ends; test the theoretical models of end loss with experiments for collisional and collisionless plasmas, with and without magnetic mirrors. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy

8.0037, EXCITATION AND IONIZATION OF HIGHLY CHARGED IONS BY ELECTRON IMPACT
D.H. Sampson, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (EY-76-S-02-2897)

The project involves calculation of the cross sections or rates for excitation and ionization of highly charged impurity ions by electron impact. This data is needed in determining the energy balance in the high temperature plasmas occurring in fusion energy research. The impurity ions are excited principally by electron impact and decay by emission of x-rays, which escape the plasma. This results in one of the principal energy loss mechanisms in the plasma. These atomic processes mostly occur at severe enough conditions that the cross sections or rates can't be directly measured and so theoretical quantum mechanical calculations are required.

SUPPORTED BY U.S. Dept. of Energy

8.0038, MICROWAVE-OPTICAL DOUBLE RESONANCE SPECTROSCOPY
Unknown, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (EY-76-S-02-3435)

The principal objective of this research project is to develop basic knowledge about the structure of matter and its interaction with radiation through the exploration of new physical and chemical phenomena. Of particular interest are short-lived chemical species which are produced by irradiation of solids with x-rays, gamma-rays, and ultraviolet light, and include electronically excited molecules, free radicals, and collective excitations in solids. Because of their short lifetimes, the development of new experimental techniques such as optical detection of magnetic resonance spectroscopy forms an integral part of this project. The results of this research will find application in environmental chemistry, laser-induced isotope separation, natural product synthesis, and energy generation, storage, and conversion devices.

SUPPORTED BY U.S. Dept. of Energy

8.0039, ELECTRON BEAM-PLASMA INTERACTIONS IN THE LABORATORY AND IN THE IONOSPHERE
W. Bernstein, Rice University, School of Natural Sciences, Dept. of Physics, *6100 Main, Houston, Texas* 77001 (NAGW 69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0040, ENERGETICS OF ATOMIC AND MOLECULAR INTERACTIONS
G.K. Walters, Rice University, School of Natural Sciences, Dept. of Physics, *6100 Main, Houston, Texas* 77001 (EY-76-S-05-4676)

This program emphasizes studies of structure and interactions of excited atoms, molecules, electrons and ions in both gases and liquids, as well as properties of and atomic interactions with solid surfaces. The program is oriented toward basic problems of relevance to the nation's energy program. Specific areas of current activity include studies of reactions and radiative lifetimes in atomic and molecular systems of high-efficiency laser promise (of interest for laser fusion, laser isotope separation), new approaches (both experimental and theoretical) to the study of solid surfaces, and ultimately heterogeneous catalysis, and understanding of spectra and collisional effects of general interest in plasma physics and controlled thermonuclear reaction technology.

The program involves 1) the use of electron (e-beam) bombardment and time-resolved spectroscopy in the study of transient excited species in dense gases of laser importance; 2) new approaches to the study of atomically clean crystalline surfaces, and their interaction with ambient gases; 3) development of tunable ultraviolet lasers; 4) theoretical studies of collision processes involving electrons, ions, atoms and molecules.

RESULTS: 1) Radiative lifetimes and reaction rates in dense rare gases and their mixtures (important to modeling and optimizing rare gas lasers); 2) demonstration of sizeable spin-polarization in low-energy electron diffraction from clean surfaces (important as new diagnostic for surface analysis, perhaps ultimately to heterogeneous catalysis); 3) advances in tunable dye laser technology; 4) new theoretical description of selected atomic and molecular collision processes and ion- and atom-surface interactions relevant to advanced energy research.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0041, STUDY OF NEUTRON-PROTON INTERACTION IN THE 300-700 MEV ENERGY REGION
Unknown, Texas A & M Research Foundation, *Faculty Exchange Box H, College Station, Texas* 77843 (EY-76-S-05-4449)

The objectives of this work are: to determine the spectrum of neutrons produced in 500-800 MeV proton bombardment of deuterium and other light elements; to use the most suitable reaction for the development of monoenergetic neutron beams needed to study the neutron-proton interaction in the 500-800 MeV energy region; to measure the differential cross sections for elastic neutron-proton scattering and for pion production in neutron-proton collisions at 500-800 MeV; to measure the neutron-proton total cross section at 500-800 MeV; to measure the neutron-proton polarization and spin-correlation parameters at 500-800 MeV. These measurements will constitute a complete determination of the neutron-proton interaction in that energy region, realizing one of the fundamental goals of intermediate-energy physics. The 500-800 MeV neutron beams will also be used to study the spectra of charged particles produced in neutron bombardment of various nuclei. The experiments will be carried out at the Los Alamos Meson Physics Facility using a magnetic spectrometer, multiwire proportional counters, scintillation counters, a polarized hydrogen target, and other appropriate instrumentation.

RESULTS: Differential cross section for np elastic scattering and angular distribution for np d P at 463,647 and 800 MeV; cross sections for np charge-exchange and nD back-angle elastic scattering at 200-800 MeV; cross sections for np positive pion and negative pion at 800 MeV; neutron spectra from 647 and 800 MeV proton bombardment of 1H, 2H and various solid targets; p and d spectra from 800 neutron bombardment of various targets.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0042, NUCLEAR SPECTROSCOPY WITH HEAVY IONS
Unknown, Texas A & M University, College Station Campus, Cyclotron Inst., *College Station, Texas* 77843 (EY-76-S-05-4322)

Heavy-ion reactions are used to populate a narrow range of spin states in residual nuclei in the rare-earth region. The mechanism of reactions such as (14N, alpha) or (19F, alpha) in which direct transfer of 10B or 15N occurs to the target nucleus is under study. Possible applications of such reactions to spectroscopic studies of high-spin states will be investigated. The use of neutron-rich incident heavy-ion beams and neutron-rich targets as a means of reducing interference from charged-particle evaporation in compound-nucleus reactions will be extended to higher bombarding energy. In-beam studies by conversion-electron spectroscopy will be continued.

RESULTS: The transitional nucleus 150Gd is well characterized below the pairing gap as a slightly anharmonic vibrator. Higher lying yrast states have negative parity and odd spin. Quasiparticle configurations appear to contribute strongly to states above spin 11. The transitional nucleus 128Ba has been found to be nearly unstable with respect to gamma deformation. An electron-gamma ray coincidence measurement has shown that the EO component in the 12 beta yields 12g transition in 154Gd is small. High-spin states in 168Hf and 172Hf have been investigated.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0043, RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY
Unknown, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (EY-76-S-05-3992)

The Center for Particle Theory's primary research mission is investigating the fundamental structure of matter. It proposes to carry out this research through a broad program of techniques currently utilized in elementary particle physics. Investigations of the fundamental quantum field theoretic method of the elementary particle interactions involves full understanding of the quantum measurement problem. In addition, whatever quantum field theoretical methods develop they must be applied to ongoing high energy experimental phenomenology. Therefore, a program using quantum field theories for the phenomenology of weak and electromagnetic interactions is proposed. Elementary particle physics developments have recently been shown to have important implications in current astrophysical problems. A program in extending the application of particle physics methods to Astrophysics will be continued. Recently the discovery of gauge fields has indicated the possibility of a unified theory of strong, weak, electromagnetic and gravitational force systems. A significant program in developing these supersymmetric theories of matter is currently underway at Texas. The methods of group theory analysis applied to particle phenomena has long been identified with the group at Texas. This program and its algebraic counterpart will continue.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0044, STUDIES OF IMPULSIVE PENETRATION AND VISCOUS INTERACTIONS
W.J. Heikkila, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (NAGW 53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0045, GALLIUM ARSENIDE (GAAS) SOLAR CELL MODELING STUDIES
J.H. Heinbockel, Old Dominion University, School of Sciences & Health Professions, Dept. of Mathematical & Computing Sciences, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0046, OPTICAL FIBER INTERFEROMETER FOR THE STUDY OF ULTRASONIC WAVES IN COMPOSITE MATERIALS
R.O. Claus, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Electrical Engineering, *Blacksburg, Virginia* 24061 (NAG 1-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0047, PION-NUCLEON INTERACTION AND MESONIC ATOMS
Unknown, University of Wyoming, Graduate School, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (EY-76-S-02-2197)

A series of experiments has been initiated to study several charge states of the reaction pi N yields pi pi N near their thresholds and to compare the average moduli of the matrix elements extrapolated to the thresholds with the predictions of soft pion theory. These experiments will test the applicability of the theory to the reactions, and will also provide more information about the processes just above the thresholds than has previously been available. The theory contains two parameters, the pion decay constants f pi which is determined consistently to 15 percent by other processes and the measure of deviation from the sigma model xi; hence at least two charge states must be studied to confirm or deny the theory. The first experiment measured d2 sigma/d lambda dT for the positive pion mesons in the center of momentum for negative pion p yields negative pion positive pion n at six energies between 229 and 356 MeV with a doubly focusing magnetic spectrometer, and these doubly differential cross sections have been integrated to find the reaction cross section. From these measurements, xi has been determined to about 10 percent for a given pion decay constant. An additional experiment now in progress will measure the cross sections for this reaction at 200 and 229 MeV to reduce the uncertainty in the process of extrapolation and hence to establish xi to about 5 percent or better. Techniques for observing other charge states will be studied and a suitable experiment proposed which will critically test the applicability of soft pion theory. If the applicability is tentatively accepted, the experiment completed would yield the most accurate measurements available for the S wave, isoscalar and isotensor pi pi scattering lengths.

In another series of experiments with the same apparatus, the cross sections for positive pion and negative pion double charge exchange in the disintegration of 16O, 40Ca and 208Pb will be measured. Comparison with theory should indicate the importance of double scattering, 3.3 resonance exchange, and nucleon-nucleon correlation in this process. (Text abridged)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, ENERGY ENVIRONMENT STUDY
R.S. Strangways, Old Dominion University, Graduate School, Dept. of Economics, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAG 1-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ABSORPTION OF SUNLIGHT IN THE ATMOSPHERE OF VENUS
M.G. Tomasko, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (NAGW 55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0002, MAINTENANCE AND OPERATION OF THE 60 INCH NASA TELESCOPE
H.P. Larson, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NAS 8-33732)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0003, OBSERVATIONS OF EMISSION IN BRIGHT, LOW REDSHIFT QUASARS
B.T. Soifer, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, DEFINITION STUDY OF THE TOTAL ABSORPTION SHOWER COUNTER
R. Hofstadter, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (NAS 5-26020)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, X-RAY EMISSION FROM T TAURI STARS
L.V. Kuhi, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-336)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0006, MICROWAVE AND THEORETICAL STUDIES RELATED TO THE COBE SATELLITE MISSION
G.F. Smoot, University of California, Berkeley Campus, Space Sciences Lab., *3 Leuschner Observatory, Berkeley, California* 94704 (NAGW 66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0007, X-RAY OBSERVATIONS OF OPTICAL ABSORPTION-LINE QUASI-STELLAR OBJECTS ON THE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
E.M. Burbidge, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAG 8-340)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, IMPROVEMENT OF DATA HANDLING AT THE LICK OBSERVATORY
L.B. Robinson, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST78-23104)

This grant supports a modest improvement in the data handling facilities for the telescopes of the Lick Observatory of the University of California. Industry compatible tape drives will be supplied so that data taken with the Image Tube Scanner, a modern, efficient detector system, can be carried to various computers for data reduction. The Image Tube Scanner is one of the most effective and productive detector systems in use in astronomy today. The excellent linearity and accurate subtraction of interfering skylight increases manyfold the observational capabilities and has extended the useful life of the Lick Observatory in the face of encroaching cities and man-made light pollution.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0009, STUDY OF CIRCUMSTELLAR SHELLS AND STELLAR WIND VARIABILITY IN SUPERGIANT STARS
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-15)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, HOLD A COLLOQUIUM ON THE SATELLITES OF JUPITER AND PUBLISH THE RESULTS IN A BOOK WITH THE SAME TITLE
Unknown, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NAGW 65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0011, INTERNATIONAL CONFERENCE ON INFRARED ASTRONOMY
D.P. Cruikshank, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Astronomy, *2444 Dole St., Honolulu, Hawaii* 96822 (NAGW 61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0012, OBSERVATIONS OF HIGHLY OBSCURED INTERSTELLAR CLOUDS
P.C. Frisch, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAG 5-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, PLAN AND ESTABLISH PRELIMINARY INTERFACES FOR THE COSMIC RAY NUCLEI EXPERIMENT
P. Meyer, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAS 5-26099)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0014, RADIO SOURCES NEAR COS-B GAMMA-RAY SOURCES
R.C. Lamb, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NAG 8-338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0015, INTERPLANETARY MONITORING PLATFORM-J DATA REDUCTION AND ANALYSIS
D.A. Gurnett, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-26125)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0016, INTERFACES BETWEEN THE ORBITER & INSTRUMENT FOR THE FAR ULTRAVIOLET TELESCOPE/SPECTROMETER (ABBREV)
A.F. Davidson, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAS 5-26057)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0017, STUDIES OF SEYFERT AND X-RAY GALAXIES
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAG 5-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0018, DEFINITION PHASE FOR TRANSITION RADIATION AND IONIZATION CALORIMETER (TRIC) TELESCOPE
G.R. Yodh, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (NAS 5-26098)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, SPECIAL OBSERVATIONS OF WU MA STARS
A.K. Dupree, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 8-344)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0020, OBSERVATIONS OF THE ULTRAVIOLET SPECTRA OF ASTRONOMICAL SOURCES
J.E. McClintock, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0021, SEARCH FOR X-RAYS FROM THE SHAKBAZYAN I GROUP OF GALAXIES AND SEARCH FOR X-RAYS FROM THE SUPERNOVA REMNANTS IN NCG 4449
R.P. Kirshner, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (NAG 8-341)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0022, INTERFACES BETWEEN SPACE TRANSPORTATION SYSTEM/SPACELAB & INSTRUMENT PER HIGH ENERGY INTERACTIONS OF COSMIC RAYS (ABBREV)
C.J. Waddington, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics & Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (NAS 5-26056)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0023, ABSORPTION MEASURES OF GALACTIC HALO GAS
L.L. Cowie, Princeton University, School of Natural Sciences, Dept. of Astronomy, *Box 430, Princeton, New Jersey* 08540 (NAG 5-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0024, ANTARES SOFT X-RAY OBSERVATIONS FROM HIGH ENERGY ASTRONOMICAL OBSERVATORY-2 & SIZE AND STRUCTURE OF AR LACERTAE CORONA (ABBREV)
D.M. Gibson, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (NAG 8-347)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0025, INTERFACES BETWEEN THE SPACE TRANSPORTATION SYSTEM/SPACELAB & INSTRUMENT FOR WIDE-BAND GERMANIUM X-RAY SPECTROMETER (ABBREV)
R. Novick, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (NAS 5-26041)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0026, GASEOUS CORONAE OF GALAXIES AND RED QUASI-STELLAR OBJECTS
A.E. Glassgold, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (NAG 8-337)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0027, SUPERNOVA-LIKE QUASARS
P.J. Huggins, New York University, Washington Square & University College of Arts & Sciences, Dept. of Astronomy, *421 1st Ave., New York, New York* 10012 (NAG 8-343)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0028, ULTRAVIOLET OBSERVATIONS OF THE CONTINUA OF NEBULAE AND THEIR EXCITING STARS
H.L. Helfer, University of Rochester, School of Arts & Sciences, Dept. of Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (NAG 5-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0029, SPECTROSCOPIC INVESTIGATIONS OF BRIGHT GASEOUS NEBULAE
S.J. Czyzak, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (NAG 5-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0030, ULTRAVIOLET STUDIES OF LATER TYPE BERYLLIUM STARS
A. Sletteback, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (NAG 5-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0031, STELLAR ENVELOPES OF ACTIVE CLOSE BINARIES TO BE OBSERVED UNDER HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
R.H. Koch, University of Pennsylvania, School of Arts & Sciences, Dept. of Astronomy, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (NAG 8-346)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0032, STATISTICS OF SPECTROSCOPICALLY IDENTIFIED WHITE DWARF STARS
E.M. Sion, Villanova University, School of Liberal Arts & Sciences, Dept. of Astronomy, *Villanova, Pennsylvania* 19085 (AST78-13396)

This grant will provide funds for updating a catalogue of spectroscopically identified white dwarf stars. The number of such stars has doubled since the first catalogue was published. In addition to including much new material in the catalogue, there will be new user additions and corrections. The updated

catalogue will contain data needed for many statistical studies of these objects. It will be valuable for studies of the kinetics, space densities, and origins of various types of white dwarf stars. The catalogue will enable astronomers to separate and classify various types of compact stars. Other applications of this catalogue include studies of the internal structure of white dwarf stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0033, A SCIENTIFIC PROGRAM IN PLANETARY ATMOSPHERIC STUDIES
A.L. Broadfoot, University of South Carolina, School of Science & Mathematics, Dept. of Physics & Astronomy, *Admin. Bldg., Room 113, Columbia, South Carolina* 29208 (NAGW 62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0034, THE CONTRACTOR SHALL DESIGN, DEVELOP, CONSTRUCT AND TEST A FULLY OPERATIONAL LUNAR LASER RANGING STATION
E. Silverberg, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NASW 3296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

10.0035, OBSERVATIONS OF SELECTED ASTRONOMICAL OBJECTS
K.H. Bohm, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 5-45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0036, X-RAY AND OPTICAL STUDY OF SYMBIOTIC STARS
G. Wallerstein, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 8-342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0037, X-RAY EMISSION AE/BE STARS - X-RAYS & UV OBSERVATIONS OF QB SUPERGIANTS - X-RAY EMISSION FROM LUMINOUS EARLY TYPE STARS (ABBREV)
J.P. Cassinelli, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 8-345)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0038, INTERFACE FOR WISCONSIN ULTRAVIOLET PHOTOELECTRIC POLARIMETER EXPERIMENT (ABBREV)
A.D. Code, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-26055)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0039, GENERATE AN INVESTIGATION DEVELOPMENT PLAN AND ESTABLISH PRELIMINARY INTERFACES FOR THE DIFFUSE SOFT X-RAY BRAGG SPECTROMETER
W.L. Kraushaar, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-26078)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0040, BACK-UP DATA ACQUISITION
L. Broglio, Universita degli Studi di Roma, *Rome, Italy* (NASW 2135)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Tracking & Data Systems

GENERAL

11.0001, OPERATION OF A STATE TECHNOLOGY APPLICATIONS CENTER (STAC) IN THE STATE OF FLORIDA
Unknown, State University System of Florida, Florida Agricultural & Mechanical University, Graduate School, *Tallahassee, Florida* 32307 (NASW 3351)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

11.0002, PHASE ONE - STUDY OF MICROWAVE RADIATION FOR SOIL STERILIZATION - PHASE TWO - ANALYSIS OF LANDSAT DATA FOR SEDIMENT IN THE CHESAPEAKE BAY
J.G. Wutok, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Natural Sciences, *Princess Anne, Maryland* 21853 (NAG 6-3)

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VOLUME 18 NUMBER 22/NOVEMBER 23, 1980

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-31305# Society of Experimental Test Pilots, Lancaster, Calif.
SOCIETY OF EXPERIMENTAL TEST PILOTS TECHNICAL REVIEW, VOLUME 14, NO. 4: 23RD SYMPOSIUM PROCEEDINGS
1980 252 p refs Symp. held at Beverly Hills, Calif., 26-29 Sep. 1979
Copyright. Avail: Issuing Activity

The design and performance of various military and civil aircraft are discussed. Other topics include runway repair, flight into icing conditions, research aircraft, the history of flight tests, as well as the history of flight. For individual titles, see N80-31306 through N80-31322.

N80-31306# McDonnell-Douglas Corp., St. Louis, Mo.
F/A-18 STATUS REPORT **c05**
John E. Krings *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 1-9 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The design and configuration details of the F/A-18 aircraft are summarized. The test programs discussed include envelope expansion, propulsion, controllability, radar, and missile compatibility tests. Problems encountered and subsequent changes and improvements made are cited. E.D.K.

N80-31307# Fairchild Republic Co., Farmingdale, N. Y.
NIGHT/ADVERSE WEATHER A-10 EVALUATOR PROGRAM (A-10B) **c05**
Wendell H. Shawler *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 10-21 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The development and flight testing of a cost effective system applicable to a ground attack system such as the A-10 and which would extend its mission capability to the night and adverse weather regime is discussed. Aircraft operability and survivability with low altitude attack is demonstrated as well as the ability to integrate tactics, sensors, and munitions to destroy a threat. The aircraft modifications required and the first flight test results of the modified aircraft are presented. E.D.K.

N80-31308# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE TORNADO ALL-WEATHER HIGH-SPEED LOW-LEVEL SYSTEM **c04**
Ludwig Obermeier *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 22-36 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The military requirement for the Tornado Interdictor/Strike version (IDS) calls for an advanced air to ground weapon system capable of striking enemy targets in areas of heavy defensive armament and electronic countermeasures under all weather and light conditions. The Tornado as an airborne weapon system was developed to meet the requirement of flexible response in all weather conditions. The role of high speed, all weather, low level flying necessitates a high precision navigation and aiming system, defensive electronics, and advanced automatic terrain following capability coupled with good ride qualities. E.D.K.

N80-31309# Air Force Flight Test Center, Edwards AFB, Calif.
F-16 EUROPEAN TEST AND EVALUATION **c05**
Thomas P. McAtee and Loren Timm *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 37-51 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

European flight tests on the F-16 were performed to qualify the aircraft for operations in adverse weather and to complete operational tests and evaluations. The results are presented from the following areas routine operations, air to air effectiveness, and air to surface effectiveness. E.D.K.

N80-31310# McDonnell-Douglas Corp., St. Louis, Mo.
YAV-8B STATUS REPORT **c05**
Charles A. Plummer, Jr. *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 52-59 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The AV-8A was modified into the YAV-8B configuration. The fuselage, cockpit, tail section, and main gear were only slightly changed. The major changes include: a supercritical airfoil to reduce transonic drag, improve maneuvering, and provide 75% more fuel storage; a second row of auxiliary inlet air doors was installed, the inlet lip shape changed, and the inlet radius increased about 1.5 inches; positive circulation is generated by large flaps interconnected with the nozzles such that full flap is obtained with approximately 50 deg of nozzle angle; and lift improvement devices which include strakes fitted to the 30 mm gun pods under the aircraft and a retractable door, or dam, which connects them at the forward end. E.D.K.

N80-31311# Air Force Flight Test Center, Edwards AFB, Calif.
HAVE BOUNCE **c05**
Richard A. Borowski *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

A variety of runway repair methods were tested. The most successful repair method is the AM-2 mat. An AM-2 mat is made up of extruded aluminum sections 2 feet wide which interlock to form a mat 54 feet wide and of any desired length. The mat is 1.5 inches thick and has a 4 foot ramp at each end. The mats are anchored in place over bomb craters that were filled and leveled. The basic method used was to validate computer simulations of F-4 aircraft dynamic response to multiple runway repairs in which structural failures were indicated. E.D.K.

N80-31312# Piper Aircraft Corp., Lockhaven, Pa.
GENERAL AVIATION ICING FLIGHT TEST **c03**
William H. Lawton *In* Society of Experimental Test Pilots Soc.

of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Flight tests into known icing were conducted using an experimental Navajo series aircraft fitted with instrumentation to document test conditions and parameters. The development of an icing tanker and flight tests are described. E.D.K.

N80-31313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA) **c05**
James L. Martin *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 77-93 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 01C

The Quiet Short-Haul Research Aircraft (QSRA) is to be used as a flight facility for advanced flight experiments in terminal area operations. The overall objective of the QSRA program is to expand the technology base of the upper surface blowing propulsive lift concept in order to establish design criteria for the aircraft industry and to establish criteria for advanced STOL aircraft. E.D.K.

N80-31314*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE STATUS **c16**
Donald K. Slayton *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 94-116 (For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 22B

Technology problems relating to the shuttle thermal protection system and the auxiliary power units for flight control of engine gimbaling and aero surfaces are examined as well as yet unresolved difficulties associated with the main engine, external tank doors, and the payload bay doors. Concepts for launch crew escape and for flight inspection are discussed, and the orbital flight test drivers are identified. The majority of OFT objectives can be accomplished in a success oriented four flight program. Carry over will be accommodated in the operational phase with a mini-DFI package. Primary shuttle systems requiring additional testings are (1) aerodynamics (forward CG); (2) thermal control system (high beta); (3) payload deployment and retrieval system (retrieval, a maximum weight, and proximity operations); (4) SSME throttling to 109%; and (5) SSME nozzle entry aerodynamic heating (up elevon/body flap position at hypersonic velocities). A.R.H.

N80-31315# Rockwell International Corp., Pittsburgh, Pa.
SABRELINER 65 **c05**
William R. Yoakley *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 119-122 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Sabreliner 65 business jet features the latest technology in fan-jet engines, supercritical wing theory, and solid state avionics. Its structural features, systems features, descriptions, and general performance are compared with those of the Sabreliner 60. A.R.H.

N80-31316# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE DEVELOPMENT OF THE WORLD'S FIRST TRIENGINE BUSINESS JET, THE MYSTERE FALCON 50 **c05**
Jerome A. Resal *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 23-137 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

To meet the demand for a business jet with a range of 2700 nautical miles, the fuselage of the F-20 was modified to accommodate three TRE731-2 engines identical to those of the F-10 aircraft. A three dimensional wing with a definite relationship to that of the F-10 and the Mercure was optimized to provide increased fuel capacity. Other changes to develop the prototype Falcon 50 are described as well as the telemetry used in its first flight test. Compared to the Falcon 20, the Falcon 50 weighs one third more, but for the same trip, burns less fuel and flies faster. It is twice as heavy as the Falcon 10 and with one more engine climbs higher. With five passengers, and full fuel (some 130 pounds under maximum gross weight), it can climb directly to 41,000 feet and fly 3500 nautical miles in still air, finishing the cruise at 45,000 feet. At maximum gross weight, the distance covered is 3300 nautical miles. Large range cruisings are set for Mach 0.72 to 0.75. A.R.H.

N80-31317# Canadair Ltd., Montreal (Quebec).
CL-600 CHALLENGER **c05**
E. D. Adkins *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 138-144 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The CL-600 aircraft has a span of 61 feet 10 inches, a length of 67 feet 9 inches, and a height of 20 feet 3 inches. The maximum takeoff weight is 36,000 pounds, and the maximum landing weight is 33,000 pounds. It is powered by two Avco Lycoming ALF-502 engines, each developing 7500 pounds of thrust at sea level. The flight flutter program and stall program are described. A.R.H.

N80-31318# Society of Experimental Test Pilots, Lancaster, Calif.
P-59 **c05**
Laurence C. Craigie *In its* Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 147-165 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The history of the development of propellerless aircraft is reviewed with particular emphasis on security measures taken during the design, production, and testing of the XP-59A, America's first jet aircraft. Special features of the Heinkel 178 and 280, the CC-1 and CC-2, the Gloster E-28/39, and the Messerschmitt 262 are also examined. A.R.H.

N80-31319# McDonnell-Douglas Corp., St. Louis, Mo.
AIRCRAFT WINGTIP COUPLING EXPERIMENTS **c05**
C. E. Anderson *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 166-184 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity

A method of increasing the range of an aircraft was investigated. The method involved attaching two free floating panels which carry fuel as extensions to the wings. The concept of this method was also extended to other uses; two escort fighters were carried along on a large bomber aircraft, without sacrifice of any bomber range. It is shown that the feasibility of this method is reliant on the proper alignment of the wingtip extensions (whatever they are), by a simple automatic flight control system. R.C.T.

N80-31320# Society of Experimental Test Pilots, Lancaster, Calif.
DEVELOPMENT OF THE GERMAN RESEARCH ESTABLISHMENT FOR GLIDING
Karl Schieferstein *In its* Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 185-208 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Various methods of aircraft towing were investigated. Specific flight tests are discussed and the results of those tests are presented. R.C.T.

N80-31321# Air Force Flight Test Center, Edwards AFB, Calif.
REVIEW OF FIVE YEARS OF FLIGHT TESTING THE B-1 **c05**
John S. Smith, III and Frederick A. Fiedler *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 209-231 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Several flight tests involving the B-1 bomber are described. Emphasis was placed on the following: terrain following; weapons systems delivery; hinge moment; electrical system malfunctions; and wing oscillations. R.C.T.

N80-31322# Aerotron, Inc., Bennington, Vt.
CROSSING THE CHANNEL IN THE GOSSAMER

ALBATROSS c05

Paul Macready *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 232-243 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The controlled, human powered flight of the Gossamer Albatross aircraft over the English channel is discussed. All significant events leading to and including the flight are described. R.C.T.

N80-31323# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

PRODUCTION ORIENTED MAINTENANCE ORGANIZATION: A CRITICAL ANALYSIS OF SORTIE-GENERATION CAPABILITY AND MAINTENANCE QUALITY M.S. Thesis

David A. Diener and Barry L. Hood Jun. 1980 179 p refs
(AD-A087095; AFIT-LSSR-52-80) Avail: NTIS HC A09/MF A01 CSCL 01/3

The Production Oriented Maintenance Organization (POMO) represents an Air Force initiative directed at improving sortie-generation capability. Although POMO is currently in use within TAC, PACAF, USAFE, and AAC, its impact has not been fully evaluated. This research was directed at determining what effect, if any, POMO has had on sortie-generation capability and aircraft quality. Six research hypothesis variables relating to sortie-generation capability and three relating to aircraft quality were evaluated to make this determination. Data were obtained from HQ ADCOM and six active duty ADCOM FISs. Performance data covered each FIS before and after POMO implementation. Research findings reflected both positive and negative results. Improvement was found in four sortie-generation variables of which three were strongly related to POMO. Degradation occurred in all three of the aircraft quality variables in the post-POMO period. Within the scope of this research, the authors conclude that, within ADCOM, POMO has had some positive effects on sortie-generation capability and some negative effects on aircraft quality. GRA

N80-31324# Vought Corp., Dallas, Tex. Maintainability Engineering Group.

MAINTAINABILITY INDEX MODEL DATA BASE STUDY Final Report, Jul. 1970 - Sep. 1979

Dennis H. Kovatch 16 Jun. 1980 83 p refs
(Contract N00140-79-C-0445)
(AD-A087844; Rept-2-57404/OR-52451) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report presents a review of ten years of aircraft maintenance data and its effects on mathematical modeling. A Maintainability Index Model (MIM) was previously developed using 3-M data from the 1975-1976 time period. Since then, maintenance data for the aircraft used to develop the MIM has increased resulting in the model under predicting current year data by 40% and life cycle data by 18%. Because of the variability and instability of 3-M data, a recommendation is made to update the model annually on an interim basis through the use of Maintenance Inflation Factors and to provide a complete update of the MIM data base every five years. GRA

N80-31325# XYZYX Information Corp., Canoga Park, Calif.

AIRCRAFT MAINTENANCE EFFECTIVENESS SIMULATION (AMES) MODEL Final Report, Oct. 1977 - Sep. 1979

David Gold, Bruce Kleine, Frank Fuchs, Sal Ravo, and Kay Inaba Feb. 1980 116 p
(Contract N61339-77-D-0028)
(AD-A087516; NAVTRAEQUIPC-77-D-0028-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report covers a project to develop and test a functional simulation model of aircraft maintenance. The model is called AMES, which means Aircraft Maintenance Effectiveness Simulation. AMES is a computer model that simulates the operation and maintenance of an aircraft squadron. It is different from other aircraft models in that it measures the effects of human errors in maintenance (maintenance accuracy). AMES is a potential tool for managers to help identify those aspects of maintenance with large payoffs for improving operational readiness and/or mission completion rate. Additionally, AMES can be used to evaluate quantitatively the effects of human factors improvements on aircraft readiness. AMES is important to the maintenance community because of its treatment of maintenance error rates. Maintenance errors are known to have a large impact on many other factors in the maintenance performance equation, e.g., elapsed time, consumption of spares, aborted missions, etc. However, this knowledge has seldom been put to good use. One reason is that errors are difficult to measure. Another reason is that the effects of errors are highly interactive, and not easily traced by conventional analysis techniques. GRA

N80-31326# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

MATHEMATICAL MODELING OF LINEAR AND NON-LINEAR AIRCRAFT STRUCTURES

Jul. 1980 38 p refs Presented at the Spring 1980 Meeting of the Struct. and Mater. Panel, Athens
(AGARD-R-687; ISBN-92-835-1365-7) Avail: NTIS HC A03/MF A01

Mathematical modeling of aircraft structures were used to determine the flutter boundaries and the dynamics of the aircraft. Specific emphasis is placed on improving the theoretically obtained flexibility and mass distributions of a structure and analyzing the nonlinear behavior of wing stores configurations. For individual titles, see N80-31327 through N80-31328.

N80-31327# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

OPTIMIZATION OF THE MATHEMATICAL MODEL OF A STRUCTURE c05

Helmut Zimmerman *In* AGARD Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980 p 1-14 refs (For primary document see N80-31326 22-01)
Avail: NTIS HC A03/MF A01

Adjustment algorithms are presented for improving the theoretically obtained flexibility or stiffness and mass distribution of such a structure by dynamic test or ground resonance test results. The necessary assumptions for the adjustment and the mathematical formalism for the adjustment procedure are given. Experiences gained and adjustment results obtained with these algorithms are reported on concentrating especially on one which uses only the measured and calculated eigenfrequencies. Proposals for improvements on the procedures and in the algorithms are also given. R.C.T.

N80-31328# Aeritalia S.p.A., Torino (Italy).

EFFECTS OF NONLINEARITIES ON WING-STORE FLUTTER c08

G. DeFerrari, L. Chesta, O. Sensburg (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich), and A. Lotze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich) *In* AGARD Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980 p 15-32 refs (For primary document see N80-31326 22-01)
Avail: NTIS HC A03/MF A01

Findings from ground resonance tests and flight flutter tests are presented and an explanation for these test results is given. Calculations with linear assumptions (parameter variations) were made and the method of harmonic balance for finding these parameters was applied. It is shown that certain levels of excitation must be reached in order to make flight flutter tests reliable for establishing flutter clearance speeds. R.C.T.

N80-31329# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

AIRCRAFT ASSESSMENT AND ACCEPTANCE TESTING

May 1980 195 p refs Lecture held in Gol, Norway, 5-6 Jun. 1980, in Athens, 9-10 Jun. 1980, and in Ankara, 12-13 Jun. 1980
(AGARD-LS-108; ISBN-92-835-0266-3) Avail: NTIS HC A09/MF A01

The present state of the art of aircraft assessment and acceptance testing of production aircraft is reviewed. Emphasis is placed on the practical aspects of this technique in order to help the flight crews and organizations dealing with this activity. Flight test instrumentation methods are set forth that do not require the use of sophisticated ground and airborne instrumentation for data acquisition or large computers for data processing. Flight test techniques described illustrate ways to acquire acceptable results utilizing a minimum of instrumentation or no

instrumentation. For individual titles, see N80-31330 through N80-31341.

N80-31330# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
SOME COMMENTS ON THE PROBLEMS INVOLVED IN AIRCRAFT ASSESSMENT AND ACCEPTANCE TESTING **c05**
J. F. Renaudie *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 26 p *ref* (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The objectives of assessment and acceptance tests and criteria for assessment are presented. The means, organization, and programs of flying, the technical programs of assessment and acceptance tests, and the technique of flight testing are also discussed. E.D.K.

N80-31331# Air Force Flight Test Center, Edwards AFB, Calif.
USAF DEVELOPMENT TEST AND EVALUATION **c05**
Laurence P. Colburn *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 13 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The test and evaluation of new weapon systems is an integral part of the total acquisition process. The major emphasis in the early development stages is placed on quantitative test and analysis to determine functional adequacy and specification compliance. Highly instrumented aircraft are used to provide data on aircraft performance, flying qualities, structural integrity, and subsystem operation. The management and test procedures used at the Air Force Flight Test Center to plan, conduct, and report on the development test and evaluation phase are presented. E.D.K.

N80-31332# British Aerospace Aircraft Group, Dunsfold (England).
SOME EXAMPLES OF PROCEDURES USED IN UK FOR ACCEPTANCE TESTING OF AIRCRAFT PRODUCED BY THE AIRCRAFT INDUSTRY UNDER GOVERNMENT CONTRACT **c05**
R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The scope of the testing carried out on instrumented aircraft is illustrated in order to indicate the range of data that can be made available to bodies evaluating a production aircraft. Aircraft are flight tested to a production flight test schedule to ensure consistent handling and performance throughout the fleet and an example of the content of a schedule is presented. Tests include measurement of aerodynamic loading and inertia loading of the airframe structure, measurement of the aircraft stability and control characteristics, measurement of thrust and lift boundaries, takeoff, landing, climb, cruise, and descent performance, and determination of engine handling characteristics. E.D.K.

N80-31333# Societe de Fabrication d'Instruments de Mesure SFIM, Massy (France). Measurement and Recording Div.
A REVIEW OF FLIGHT TEST INSTRUMENTATION SYSTEMS FOR ACCEPTANCE TESTING OF THE PRODUCTION AIRCRAFT **c06**
Claude Robert *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 3 p (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

A definition is given of flight test instrumentation. Two cases considered are that the aircraft is fitted with a crash recording system and that no special recording means are available on the aircraft. A general description of present accident recording systems is presented. E.D.K.

N80-31334# Air Force Flight Test Center, Edwards AFB, Calif.
PERFORMANCE TESTING PRODUCTION AIRLINES **c05**
Roger C. Crane *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 27 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

A discussion of basic performance testing and data analysis concepts along with pretest information requirements are presented. Ground tests such as instrumentation calibrations, installed static thrust calibrations, and airplane gross weight and center of gravity checks are outlined. Flight tests which enable static source position error determination, as well as an assessment of takeoff, cruise, acceleration, and turning performance are discussed. Also described are tests that enable assessments of the engine handling characteristics of the airplane. The presentation and analysis of the data acquired during each type of tests are also outlined with emphasis on using test day data as opposed to test day data corrected to standard day conditions. E.D.K.

N80-31335# British Aerospace Aircraft Group, Dunsfold (England).
EVALUATION OF LONGITUDINAL CHARACTERISTICS INCLUDING STABILITY HANDLING AND CG RANGE **c08**
R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

Tests used by contractors to assess the longitudinal stability and control characteristics of an aircraft are enumerated to give an indication of the measured flight test data that can be made available to an evaluating body. Simple flight tests to obtain qualitative and quantitative data on static, maneuver and dynamic stability, low speed handling, turning performance and high Mach number effects during an evalaution are also described. E.D.K.

N80-31336# British Aerospace Aircraft Group, Dunsfold (England).
EVALUATION OF LATERAL AND DIRECTIONAL CHARACTERISTICS AND SPINNING BEHAVIOUR **c08**
R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 12 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The lateral and directional handling characteristics that should be investigated during an evaluation of an aircraft already tested by a contractor and test techniques utilizing limited flight test instrumentation to gather quantitative data are described. An approach to the assessment of spin entry and recovery behavior is also presented. E.D.K.

N80-31337*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT RESEARCH TECHNIQUES UTILIZING REMOTELY PILOTED RESEARCH VEHICLES **c06**
R. Dale Reed *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 15 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The use of the remotely piloted research vehicle (RPRV) in aeronautical research is surveyed. The flight test experience that has been acquired with several types of RPRV's including those with a pilot in the loop is emphasized. The approaches utilized range from the simplest and least expensive of vehicles, such as the Minisniffer, to the sophisticated highly maneuverable aircraft technology (HiMAT) RPRV. The advantages and disadvantages of RPRV's are discussed, as well as safety considerations. The ground rules set early in a program can profoundly affect program cost effectiveness and timeliness. M.G.

N80-31338# Air Force Flight Test Center, Edwards AFB, Calif.
QUALITATIVE ARMAMENT SUBSYSTEM ASSESSMENT **c05**
Lawrence P. Colburn *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

A qualitative approach to armament subsystem tests, the objectives which can be achieved, and analysis methods for the major aircraft weapon systems are addressed. It is concluded that a qualitative evaluation of the armament subsystem can provide the basis for determining the operational effectiveness and suitability of the system for procurement. A substantial amount of information may be gathered to evaluate a weapon system

without extensive or sophisticated instrumentation. Minimal aircraft and weapon range instrumentation requirements are detailed. M.G.

N80-31339# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).

ELECTRO-MAGNETIC COMPATIBILITY c32

Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)

Avail: NTIS HC A09/MF A01

The historical background to the growth in problems of electromagnetic compatibility (EMC) in UK Military aircraft is reviewed and the present approach for minimizing these problems during development is discussed. The importance of using representative aircraft for final EMC assessments is stressed, and the methods of approach in planning and executing such tests are also outlined. The present equipment qualification procedures are based on assumptions regarding the electromagnetic fields present within the airframe, and the nature of the coupling mechanisms. These cannot be measured with any certainty in representative aircraft. Thus EMC assessments rely on practical tests. Avionics systems critical to flight safety, and systems vital to mission effectiveness require test methods that provide a measure of the safety and performance margins available to account for variations that occur in production and service use. Some proven methods are available, notably for detonator circuits, but in most other areas further work is required. Encouraging process has been made in the use of current probes for the measurement of interfering signals on critical signal lines, in conjunction with complementary test house procedures, as a means for obtaining the safety margins required in flight and engine control systems. Performance margins for mission systems using digital techniques are difficult to determine, and there is a need for improved test techniques. The present EMC qualification tests for equipment in the laboratory do not guarantee freedom from interference when installed, and the results are limited in value for correlating with aircraft tests. M.G.

N80-31340# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).

CHECKING OF COMMUNICATIONS AND RADIO NAVIGATION SYSTEMS c32

Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 24 p refs (For primary document see N80-31329 22-01)

Avail: NTIS HC A09/MF A01

The testing of aircraft communications and radio navigation systems is addressed. Limited assessments need to take account of variations in ground station performance, and uncertainty regarding radio wave propagation conditions. Antenna performance can vary markedly in different aircraft to affect the radial coverage of all systems, or the accuracy achieved by direction finding equipment. Aircraft transmitting antenna characteristics can be quantified for a relatively modest outlay on ground station equipment, and subjective communications quality assessments can be enhanced by using suitable yet inexpensive voice recorders that are also useful for noting observed navigation data for subsequent analysis. An accompanying aircraft of known performance can provide a comparative basis for the assessment of range performance and provide the means for checking air to air modes. Test objectives should be related to the intended operational use of the aircraft, but need to be interpreted into schedules for use over standard test routes, that have the widest application for all classes of aircraft. An example is given of a possible schedule of tests and the form of analysis that might apply. M.G.

N80-31341# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

PERFORMANCE OF NAVIGATION SYSTEMS c04

Karlheinz Hurrass *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)

Avail: NTIS HC A09/MF A01

The radio navigation systems of VHF omnidirectional range/distance measuring equipment (VOR/DME) and the tactical air navigation system, as well as Doppler navigation and inertial navigation are described to show in which way and how far they can be used. Their error behavior is described especially and in detail. It is suggested that by combining various navigation systems, navigation accuracy can be greatly increased. One integrated system is dealt with and explained with the aid of flight tests. The system consists of a simple dead-reckoning system aided by DME distance measurements. Both systems are integrated by emans of a Kalman filter. The dead-reckoning system uses heading, true air speed, and an estimated velocity of the wind. The DME-interrogator is constantly switched over to frequencies of different ground stations (multiple DME). M.G.

N80-31342# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

THE APPLICATION OF DESIGN TO COST AND LIFE CYCLE COST TO AIRCRAFT ENGINES

May 1980 168 p refs Conf. held at Saint Louis, France, 12-13 May 1980 and London, 15-16 May 1980 (AGARD-LS-107; ISBN-92-835-0265-5) Avail: NTIS HC A08/MF A01

The cost of design and development of weapon systems must include not only the cost of production but also deployment training, operational use, and support. The latest methodologies of cost/performance comparison and tradeoffs for aircraft engines are examined with emphasis on data collection, analysis, modelling and estimating all development and operations costs. Contractual provisions and the costs related to incentives for performance and reliability are included. For individual titles, see N80-31343 through N80-31349.

N80-31343# RAND Corp., Washington, D. C.

AN APPROACH TO THE LIFE CYCLE ANALYSIS OF AIRCRAFT TURBINE ENGINES c07

J. R. Nelson *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 27 p refs (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

A methodology derived from historical data for life cycle analysis of aircraft turbine engines is described and applied at the engine subsystem and aircraft systems levels. The methodology enables the weapon system planner to acquire early visibility of cost magnitudes, proportions, and trends associated with a new engine's life cycle, and to identify drivers that increase cost and can lower capability. The procedure followed was to develop a theoretical framework for each phase of the life cycle; collect and analyze data for each phase; develop parametric cost estimating relationships (CERs) for each phase; use the CERs in examples to ascertain behavior and obtain insights into cost magnitudes, proportions, and trends, and to identify cost drivers and their effects; and examine commercial experience for cost data and operational and maintenance practices. A.R.H.

N80-31344# Ministry of Defence, London (England).

DESIGN TO LIFE CYCLE COSTS INTERACTION OF ENGINE AND AIRCRAFT c07

E. J. Jones *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 15 p (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

The distribution of life cycle costs for a typical combat aircraft between airframe, avionics and engine is discussed. Distribution of costs for the aircraft between development, production, initial support and operation and support is compared with the distribution for the engine. The effect of fleet size and service life upon the life cycle costs are indicated. The large commitment of life cycle costs early in the conceptual and feasibility phase of the program is indicated. The choice of engine is an example of this early commitment. The relative effect of the choice of single or twin engine installation of a derated engine or the use of an existing engine upon the engine life cycle costs, and the interaction with aircraft costs is discussed. The severe operating conditions for the engine of a combat aircraft are reviewed. Reduced support costs are not expected to give a large fold return on extra engine development investment. A.R.H.

N80-31345# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aeronautical Systems Div.

PROGRESS ON THE US AIR FORCE APPROACH FOR THE PRACTICAL MANAGEMENT OF ENGINE LIFE CYCLE COSTS c07

Richard E. Steere, Edward G. Koepnick, and Robert A. Dean *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to *Aircraft Eng.* May 1980 10 p refs (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

Efforts to more effectively influence the life cycle costs of newly acquired gas turbine power plants are reviewed. A combination of technical and business practice initiatives was undertaken or planned across the entire life cycle spectrum, *i.e.*, from first entry with the exploratory development program through the decision to phase the product out of the active inventory. The status of technical and management activities is addressed and various business concepts and strategies being studied by the U.S. Air Force which complement the earlier initiatives as they impact engine life cycle costs are presented. The role of the USAF Propulsion System Program Office as the *continuing focal point for these life cycle efforts is discussed.* The ideas presented are not new as they have been employed successfully at one time or another on an individual basis in *the development and support of military and commercial gas* turbine power plants. What is new, is the systems management view of the life cycle process and what can be done practically *today vs tomorrow to enhance engine life cycle costs in an* integrated fashion. A.R.H.

N80-31346# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).

***MILITARY ENGINE* PROGRAMS WITH COST OBJECTIVES [PROGRAMMES DE MOTEURS MILITAIRE A OBJECTIES DE COUT]** c07

Claude Foure In AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 28 p In FRENCH (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

Approaches discussed include the analysis of value; reliability *and maintainability studies; the direct operating cost of motor* parts as considered by aircraft companies; and the management of efforts in technological progress. Topics covered include means for forecasting costs *which are desirable to set at each phase* of the program; the types of organization adapted to such programs; and possible action to be taken when the objectives *are fixed or revised after initial definition, with or without* modification of the definition. Economy measures related to the high cost of fuels and return from the value concept and tradeoffs *are also examined.* Transl. by A.R.H.

N80-31347# General Electric Co., Lynn, Mass. Aircraft Engine Group.

LOGISTICS FORECASTING FOR ACHIEVING LOW LIFE CYCLE COST c81

G. Walker *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 25 p refs (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

The on condition maintenance concept (OCM) provides the potential for reduced life cycle costs (LCC) by fully utilizing potential parts life and reducing maintenance frequency. With the advent of OCM logistics requirements are heavily influenced by wearout characteristics and usage severity. In such cases more sophisticated forecasting methods are required which realistically represent the dynamics of the logistics system inherent in such a maintenance philosophy. If efficient logistics management is to be attained, such forecasting tools should also provide the capability to perform tradeoff studies on the cost effectiveness of alternative maintenance or logistics systems. The use of modelling methods which are proving practical in forecasting and tradeoff analyses and therefore in establishing an optimum logistics and support environment is explored. Methods discussed include the consideration of wearout characteristics where components exhibit an age related replacement rate, and also replacement of components which may have a specified maximum life in terms of operating cycles or mission severity. The use of engine history recorders and parts tracking systems and their impact on achieving optimum LCC is also discussed. A.R.H.

N80-31348# Rolls-Royce Ltd., Bristol (England). Aero Div.

THE APPLICATION OF DESIGN TO COST AT ROLLS-ROYCE c07

R. J. Symon and K. J. Dangerfield *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 17 p (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

Experience in evolving and applying a formal design to cost discipline is described in chronological order of the main events which occurred during the last five years with brief reference to *the previous period. A new type of department was created to* face the principal problem, that control of costs requires interactive links between the management disciplines at all levels. The way *in which this group fits into the existing organization to ensure* that effective cost control becomes part of the established routines is discussed. Comments are made on the nature of cost and its *fundamental difference from the other parameters which the* designer has traditionally managed. Conclusions likely to apply to any commercial manufacturing company are suggested and *comments made regarding the future responsibility of engineers* in determining the financial success of the companies for which they work. Complementary roles for management and financial *accountants to support the new responsibilities of the engineers* are also indicated. A.R.H.

N80-31349# Boeing Aerospace Co., Seattle, Wash. Systems Cost Analysis Div.

EVALUATING AND SELECTING THE PREFERRED AIR BREATHING WEAPON SYSTEM c07

Frank A. Watts *In* AGARD The Appl. of Design to Cost and *Life Cycle Cost to Aircraft Eng.* May 1980 16 p (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

The life cycle costs of three equally effective strategic forces are discussed with the objective of isolating the preferred air breathing component. Terms are defined, cost elements are *reviewed, and an example is described in which various strategic* forces containing advanced aircraft are compared and the preferred choice is dependent on whether least cost is measured by short *term, long term, or intermediate budgetary considerations.* A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-31350*# De Havilland Aircraft Co. of Canada Ltd., Ottawa (Ontario).

PHASE 2 AND 3 WIND TUNNEL TESTS OF THE J-97 POWERED, EXTERNAL AUGMENTOR V/STOL MODEL

D. B. Garland and J. L. Harris Mar. 1980 174 p refs (Contract NASw-2797)

(NASA-CR-163578; DHC-DND-80-1) Avail: NTIS HC A08/MF A01 CSCL 01A

Static and forward speed tests were made in a 40 multiplied by 80 foot wind tunnel of a large-scale, ejector-powered V/STOL aircraft model. Modifications were made to the model following earlier tests primarily to improve longitudinal acceleration capability during transition from hovering to wingborne flight. A rearward deflection of the fuselage augmentor thrust vector was shown to be beneficial in this regard. Other augmentor modifications were tested, notably the removal of both endplates, which improved acceleration performance at the higher transition speeds. The model tests again demonstrated minimal interference of the fuselage augmentor on aerodynamic lift. A flapped canard surface also showed negligible influence on the performance of the wing and of the fuselage augmentor. T.M.

N80-31351*# United Technologies Research Center, East Hartford, Conn.

INFLUENCE OF MISTUNING ON BLADE TORSIONAL FLUTTER

A. V. Srinivasan Aug. 1980 55 p refs
(Contract NAS3-21603)
(NASA-CR-165137; R80-914545-16) Avail: NTIS HC A04/MF A01 CSCL 01A

An analytical technique for the prediction of fan blade flutter was evaluated by utilizing first stage fan flutter data from tests on an advanced high performance engine. The formulation includes both aerodynamic and mechanical coupling among all the blades of the assembly. Mistuning is accounted for in the analysis so that individual blade inertias, frequencies, or damping can be considered. Airfoil stability was predicted by calculating a flutter determinant, the eigenvalues of which indicate the extent of susceptibility to flutter. When blade to blade differences in frequencies are considered, a stable system is predicted for the test points examined. For a tuned system, it was found that torsional flutter can be predicted at a limited number of interblade phase angles. Examination of these phase angles indicated that they were 'close' to the condition of acoustic resonance. For the range of Mach numbers and reduced frequencies considered, the so called subcritical flutter cannot be predicted. The essential influence of mechanical coupling among the blades is to change the frequencies of the system with little or no change in damping; however, aerodynamic coupling together with mechanical coupling could change not only frequencies, but also damping in the system, with a trend toward instability. A.R.H.

N80-31352*# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
AN ASYMPTOTIC UNSTEADY LIFTING-LINE THEORY WITH ENERGETICS AND OPTIMUM MOTION OF THRUST-PRODUCING LIFTING SURFACES Final Report
Ali Reza Ahmadi Sep. 1980 345 p refs
(Grant NGR-22-009-818)
(NASA-CR-163526; MIT-80-2) Avail: NTIS HC A15/MF A01 CSCL 01A

A low frequency unsteady lifting line theory was developed for a harmonically oscillating wing of large aspect ratio. This wing was assumed to be chordwise rigid but completely flexible in the span direction. The theory was developed by use of the method of matched asymptotic expansions which reduces the problem from a singular integral equation to quadrature. The wing displacements were prescribed and the pressure field, airloads and unsteady induced downwash were obtained in closed form. The influence of reduced frequency aspect ratio, planform shape and mode of oscillation on wing aerodynamics was demonstrated through numerical examples. Compared with lifting surface theory computation time was reduced significantly. R.C.T.

N80-31353*# Razak (Kenneth), Wichita, Kans.
COMPUTATION OF SPANWISE DISTRIBUTION OF CIRCULATION AND LIFT COEFFICIENT FOR FLAPPED WINGS OF ARBITRARY PLANFORM Final Report
Kenneth Razak Aug. 1980 61 p refs
(Contract NAS1-15249)
(NASA-CR-159329) Avail: NTIS HC A04/MF A01 CSCL 01A

The question of the effect of distribution and magnitude of spanwise circulation and shed vorticity from an airplane wing on the distribution pattern of agricultural products distributed from an airplane was studied. The first step in an analysis of this question is the determination of the actual distribution of lift along an airplane wing, from which the pattern of shed vorticity can be determined. A procedure is developed to calculate the span loading for flapped and unflapped wings of arbitrary aspect ratio and taper ratio. The procedure was programmed on a small programmable calculator, the Hewlett Packard HP-97, and also was programmed in BASIC language. They could be used to explore the variations in span loading that can be secured by variable flap deflections or the effect of flying at varying air speeds at different airplane gross weights. Either an absolute evaluation of span loading can be secured or comparative span loading can be evaluated to determine their effect on swath width and swath distribution pattern. The programs are intended to assist the user in evaluating the effect of a given spanload distribution. J.M.S.

N80-31354# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
A CRITICAL COMMENTARY ON MEAN FLOW DATA FOR TWO-DIMENSIONAL COMPRESSIBLE TURBULENT BOUNDARY LAYERS
H. H. Fernholz May 1980 229 p refs
(AGARD-AG-253; AGARDograph-253; ISBN-92-835-1362-2)
Avail: NTIS HC A11/MF A01

A discussion of mean flow profile data for compressible boundary layers is presented. The commentary includes discussion of the theoretical basis for interpretation of measurements, concepts from low speed studies, and interpretation of mean flow data with and without pressure gradient. The causes of normal pressure gradients are described, so as to allow an estimation of their magnitude and their influence on boundary layer scale lengths. E.D.K.

N80-31355# Nielsen Engineering and Research, Inc., Mountain View, Calif.
BASIC STUDIES OF WING-BODY INTERFERENCE AT HIGH ANGLES OF ATTACK AND SUPERSONIC SPEEDS Final Report, 1 Jun. 1978 - 31 May 1979
Goetz H. Klopfer and Jack N. Nielsen Oct. 1979 82 p refs
(Contract N00014-78-C-0490; RR0141184)
(AD-A087134; NEAR-TR-206; ONR-CR-215-263-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

The problem of computing the steady inviscid supersonic flows about thin wings having sharp subsonic leading edges and leading edge separation is solved in this paper. Both wings alone or wings in the presence of the body are considered. To obtain an efficient procedure the steady Euler equations are used as the basic governing equations as opposed to the more complicated Navier-Stokes equation. The viscous effects, important near the sharp leading edges, are simulated by a Kutta condition applied at the leading edges of the wings. The rest of the flow field is essentially controlled by the inviscid equations. The equations, written in conservation form in generalized curvilinear coordinates, are approximated by MacCormack's second-order accurate predictor-corrector algorithm. The flow tangency conditions at the body surface are satisfied by Abbett's scheme and the outer bow-shock position by the Rankine-Hugoniot jump relations. Internal shock waves or tangentially discontinuities are captured. The slip surface emanating from the leading edge of the sharp wing excited nonlinear instabilities in the MacCormack's scheme, which were stabilized by special flow dependent fourth order damping terms. GRA

N80-31356# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
MODEL SCALE EFFECTS ON A 16-309 FLAPPED HYDROFOIL SECTION
Eric A. Jones Apr. 1980 46 p refs
(AD-A087343; DREA-TM-80/B) Avail: NTIS HC A03/MF A01 CSCL 20/4

Wind and water tunnel testing of a NACA 16-309 hydrofoil section with the standard a = 1.0 camber line and equipped with a 25% flap-chord ratio, simple, sealed flap is reported. Differences between test results from the two facilities are discussed, as well as the effect of placing roughness strips near the leading edge. Results are given showing the dependency of force, moment, and, in particular, cavitation inception on Reynolds number over the range from 1.25 to 4.0 million. M.G.

N80-31357# ARO, Inc., Arnold Air Force Station, Tenn.
STORE SEPARATION TESTING TECHNIQUES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. VOLUME 2: DESCRIPTION OF CAPTIVE TRAJECTORY STORE SEPARATION TESTING IN THE AERODYNAMIC WIND TUNNEL 4T Final Report, 1 Oct. 1978 - 30 Sep. 1979
J. B. Carman, Jr., D. W. Hill, Jr., and J. P. Christopher AEDC Jun. 1980 134 p refs 4 Vol.
(AD-A087561; AEDC-TR-79-1-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/4

This report describes the current captive trajectory support (CTS) hardware, system operation, and the captive trajectory applications program for the Aerodynamic Wind Tunnel (4T). Also included are brief descriptions of additional CTS applications and some guidelines for potential users of the system. GRA

N80-31358# ARO, Inc., Arnold Air Force Station, Tenn.
STORE SEPARATION TESTING TECHNIQUES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. VOLUME 4: DESCRIPTION OF DYNAMIC DROP STORE SEPARATION TESTING Final Report, 1 Oct. 1978 - 30 Sep. 1979
E. G. Allee, Jr. Jun. 1980 40 p refs 4 Vol.
(AD-A087490; AEDC-TR-79-1-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 20/4

Dynamic drop testing is a method of trajectory simulation whereby store models which are both geometrically and dynamically scaled are released in the wind tunnel air stream and the resulting trajectories are mapped photographically. Drop testing is often used when captive trajectory testing is not feasible or for final trajectory verification prior to flight tests. GRA

N80-31359# Dayton Univ., Ohio. Applied Mathematics Group.
THE TREATMENT OF THE SONIC LINE AND OF SHOCKS IN A FINITE ELEMENT APPROACH TO TRANSONIC FLOW COMPUTATIONS Interim Report, Oct. - Dec. 1979
Karl G. Guderley Wright-Patterson AFB, Ohio AFWAL Feb. 1980 41 p refs
(Grant AF-AFOSR-3524-78; AF Proj. 2304)
(AD-A087740; UDR-TR-80-32; AFWAL-TR-80-3046) Avail: NTIS HC A03/MF A01 CSCL 20/4

Even if one uses the same shape functions throughout in a finite element computation of transonic flow fields, one must, for reasons of stability, apply the weights differently in the subsonic and supersonic regions. In the present report this aspect is accepted without further discussion. It is necessary, in addition, to impose special conditions at the sonic line and at the line where one returns from supersonic to subsonic speeds. These conditions are first explored by means of a semidiscretization. (The differential operators are discretized with respect to the direction normal to the streamlines, but not with respect to the streamline direction.) The resulting system of ordinary differential equations has singular points, whose position is related to the transition from one regime to the other. These singularities are compatible with weak solutions of the problems. (Finite difference and finite element solutions are realizations of the concept of weak equality.) But from the physical point of view these singularities are not admissible, at least not in the transition from a subsonic to a supersonic speed. One thus obtains the requirements that at the sonic line the partial differential equation be satisfied in the strong sense. GRA

N80-31360# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
RANGES AND CRITICAL VALUES OF ADVANCE RATIO FOR BLADE/VORTEX INTERSECTION PATTERNS OF A HELICOPTER ROTOR
L. R. Lucassen Jul. 1979 31 p refs Presented at 5th European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 5-7 Sep. 1979
(NPL-MP-79030-U) Avail: NTIS HC A03/MF A01

The free vortices trailing from the tip of helicopter rotor blades lead to large changes in induced velocity and local angle of attack, resulting in peaks in aerodynamic loading. For a single rotor in forward flight an analysis was performed on the geometry of blade/vortex intersection, while an undistorted, in-plane wake is assumed. This showed the existence of seven ranges of advance ratio, each range being characterized by a different blade/vortex intersection pattern. These ranges are separated by six critical advance ratios, which are functions only of the ratio between the number of rotor blades and the serial number index of the preceding blade or tip vortex. The lowest critical advance ratio is in agreement with data published on the position of a ripple in the power required curves for level flight, as measured for several helicopter types. Author (ESA)

N80-31361# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
DESIGN OF A CALCULATION METHOD FOR THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS
J. P. F. Lindhout and B. vandenBerg 29 Nov. 1979 14 p refs Presented at the 3d GAMM Conf. on Numerical Methods in Fluid Mech., Cologne, 10-12 Oct. 1979
(Contract NIVR-1820)
(NLR-MP-79036-U) Avail: NTIS HC A02/MF A01

An engineering method is presented to compute the three dimensional laminar and turbulent boundary layer flow over nondevelopable surfaces. Turbulence phenomena are described by a simple eddy viscosity model. The method was organized to enhance its user oriented properties. The organization and the numerics are discussed in the framework of relational diagrams which elucidate the relations between information sets and processes. Results are shown for the laminar flow over a flat plate with an attached cylinder and for the turbulent flow over the root section of an aircraft wing. Author (ESA)

N80-31362# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATIONS BY A FIRST ORDER THEORY OF SUPERSONIC FLOW AROUND DELTA WINGS
S. G. Hedman 1980 22 p refs
(Contract FMV-F-INK-11-12-93490)
(FFA-TN-AU-810) Avail: NTIS HC A02/MF A01

Preliminary calculations of delta wings in supersonic flow were made with a method based on theoretical work of Oswatitsch and Sun. The flow field is computed with acoustic theory for an image wing in the characteristic space. Following that, the real wing's coordinates in physical space are calculated. The planform of the image wing must be modified until the corresponding real wing has obtained the wanted shape. The theory is of first order accuracy expressed in the characteristic variables. Traces of the characteristics in physical space and bow shock waves were found for cases with wings with and without incidence. As the wing disturbances increase it becomes more difficult to give to the real wing the wanted shape. The possible practical use of the method is probably limited to slender wings at small incidences. Author (ESA)

N80-31363# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONTRIBUTION TO THE STUDY OF SUPERSONIC LAMINAR SEPARATION: UTILIZATION AND IMPROVEMENTS IN INTEGRAL METHODS OF CALCULATION Ph.D. Thesis - Lille Univ.
Gilles About 1980 90 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-662)
(ONERA-NT-1980-1; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

Calculations were performed on supersonic layer separation phenomena by solving coupled perfect fluid equations and integral form boundary layer equations. Three types of improvements are suggested: definition of similitude profiles approximated by a simple analytical representation and the use of a second order boundary layer formulation proposed by Crocco, adaptation of Le Balleur's numerical method and its application to separated and reattaching flow on a compression ramp or under shock wave reflection conditions; and determination of three parameter velocity profiles able to take sublaminar layers into account and their utilization in a three moment integral method as suggested by Crocco. Author (ESA)

N80-31364# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
AN INVESTIGATION OF SCALE EFFECTS ON THE TRANSONIC FLOW OVER SWEPT WINGS. PART 1: MEASUREMENTS ON A MODEL OF A TRANSPORT-AIRCRAFT CONFIGURATION
D. J. Weeks London Aeronautical Research Council Nov. 1976 126 p refs Supersedes RAE-TR-76158; ARC-37486 (ARC-R/M-3842-Pt-1; BR74033; RAE-TR-76158; ARC-37486) Avail: NTIS HC A07/MF A01; HMSO £14 PHI

Measurements of forces and wing pressures at Mach numbers 0.70, 0.79 and 0.85, and at Reynolds numbers in the range 1.7 million to 13.6 million, on a half model of a transport-aircraft-type wing-body combination, were analyzed to show the effects of changes of Reynolds number and transition position on the transonic flows over the upper surface of the wing at high incidence. Each of the three Mach numbers provides a different example of flow development and form of scale effect. Author (ESA)

N80-31365# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
JET INTERFERENCE ON SUPERCRITICAL WINGS. PART 1: EXPERIMENTS ON A TWO-DIMENSIONAL WING. PART 2: EXPERIMENTS ON A SWEPT WING
J. A. Bagley and A. G. Kurn London Aeronautical Research Council Jan. 1977 105 p refs Supersedes RAE-TM-77007; RAE-TM-77008; ARC-37279; ARC-37281
(ARC-R/M-3845; BR74032; RAE-TR-77007; RAE-TR-77008; ARC-37279; ARC-37281) Avail: NTIS HC A06/MF A01; HMSO £15 PHI

Wind tunnel tests were made to investigate the influence of the jet from several different nozzles on the pressure distribution on adjacent wing panels with supercritical profiles. An existing unswept wing panel was used for one test; a 25 deg swept wing panel was used for the other and additional measurements were made with pylons fitted to two of the nozzles. The nozzle shapes and their location relative to the wing were chosen to represent a modern airbus configuration with fan engines. The results indicate that, in the cruise configuration, the influence of the jet is fairly small, and in most cases it simply reinforces certain features of the pressure distribution measured without jet blowing. Author (ESA)

N80-31366# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
WIND TUNNEL MEASUREMENT OF LATERAL AERODYNAMIC DERIVATIVES USING A NEW OSCILLATORY RIG, WITH RESULTS AND COMPARISONS FOR THE GNAT AIRCRAFT
C. O. OLeary London Aeronautical Research Council Oct. 1977 45 p refs Supersedes RAE-TR-77159; ARC-37724
(ARC-R/M-3847; BR74569; RAE-TR-77159; ARC-37724) Avail: NTIS HC A03/MF A01; HMSO £10 PHI

The investigation of aircraft handling characteristics at high angle of attack and high subsonic speeds is hampered by the lack of accurate data on aerodynamic derivatives. The development of a rig and method of test for the measurement of oscillatory lateral aerodynamic derivatives under these conditions is described. Tests were made on a 0.16 scale model of a Gnat T Mk 1 aircraft and the results compared with those from wind tunnel static tests, flight tests and estimates. Agreement with the other data is reasonably close except in the case of some cross damping derivatives. The accuracy of measurement of derivatives due to rate of roll should be improved by a proposed design of the excitation system. Author (ESA)

N80-31367# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
MEASUREMENTS OF PRESSURE DISTRIBUTIONS AND PRESSURE DRAGS AT ZERO INCIDENCE ON BOTH BLUNT AND SHARP AXISYMMETRIC FOREBODIES AT A MACH NUMBER OF 3
L. C. Ward London Aeronautical Research Council Nov. 1976 33 p refs Supersedes RAE-TR-76160; ARC-37355
(ARC-R/M-3849; BR74568; RAE-TR-76160; ARC-37355) Avail: NTIS HC A03/MF A01; HMSO £8 PHI

Surface pressure distrubutions measured on a number of axisymmetric forebodies at zero incidence and a Mach number of 3 are presented. Integrated pressure drags are compared with the theoretical drags of sharp cones having the same forebody fineness ratios, showing that significant drag reductions can be achieved at this Mach number by the suitable use of nose blunting, leading also to an increase of usable volume in the forebody. Results are compared with published data for determining the pressure drag of spherically blunted cones. Author (ESA)

N80-31368# Royal Aircraft Establishment, Farnborough (England).
A BRIEF INVESTIGATION OF THE TWO-DIMENSIONALITY OF THE FLOW OVER AN AIRFOIL IN THE 8 FOOT BY 6 FOOT TRANSONIC WIND TUNNEL
P. H. Cook and M. A. McDonald London HMSO Dec. 1979 20 p refs
(RAE-TM-Aero-1828; BR72384) Avail: NTIS HC A02/MF A01

Oil flow on the surface and pitot pressure measurements in the wake of a 0.762 m chord airfoil in a 8 ft x 6 ft tunnel indicate that there is no significant spanwise convergence or divergence of the flow within the boundary layer and wake of the model. The measurements were made at subsonic conditions where no regions of separated flow existed on the model, but where significant subsonic drag creep had previously been measured. Author (ESA)

N80-31369# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
A NUMERICAL METHOD FOR THE CALCULATION OF LAMINAR INCOMPRESSIBLE BOUNDARY LAYERS WITH STRONG VISCOUS-INVISCID INTERACTION
A. E. P. Veldman 7 Mar. 1979 49 p refs
(NLR-TR-79023-U) Avail: NTIS HC A03/MF A01

A method for the calculation of boundary layers with strong viscous inviscid interaction is presented. The method differs from the classical methods for solving boundary layer equation, through the use of an interactive boundary condition which replaces the usually prescribed pressure. This boundary condition describes how the outer potential flow reacts on the presence of the boundary layer. The method is demonstrated on two problems: a boundary layer with a separation bubble and the flow near the trailing edge of a flat plate. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-31370# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF THE FUTURE REQUIREMENTS FOR MATERIALS HANDLING EQUIPMENT IN THE MILITARY AIRLIFT COMMAND
Christopher Carson and Charles D. Munson Jun. 1980 107 p refs
(AD-A087094; AFIT-LSSR-35-80) Avail: NTIS HC A06/MF A01 CSCL 15/5

Civilian wide-bodied aircraft are presently used to augment the Military Airlift Command's airlift capability. Many analysts believe that this wide-body usage will increase in the future. However, even today, the basic 463L materials handling equipment system (e.g., K-loaders) cannot accommodate civilian wide-bodies. Cargo loader adapters and modifications have proven infeasible, necessitating the use of elevators for loading/unloading operations. Therefore, the purpose of this study was to examine whether the United States Air Force should continue to write specifications around the present K-loaders, or initiate acquisition of a cargo loader capable of interfacing with both military aircraft and civilian wide-bodied aircraft. The examination of these two decision alternatives involved three main phases: (1) a forecast of the future U.S. wide-body and narrow-body market, (2) a determination of Military Airlift Command's future loader requirements based on predicted changes in cargo activity, and (3) a net present value analysis of system costs built on various policies for loader replacement. After the results of these phases were obtained, the authors concluded that the Air Force should continue to acquire, operate, and maintain its present K-loader system. GRA

N80-31371# School of Aerospace Medicine, Brooks AFB, Tex.
CRITICAL INTERFACES BETWEEN ENVIRONMENT AND ORGANISM IN CLASS A MISHAPS: A RETROSPECTIVE ANALYSIS Final Report, 30 Aug. - 27 Dec. 1978
Stan R. Santilli Jun. 1980 44 p refs
(AF Proj. 7930)
(AD-A087341; SAM-TR-80-5) Avail: NTIS HC A03/MF A01 CSCL 01/2

Aircraft mishap prevention efforts in the past have been extremely successful. Since 1970 the mishap rate decrease has leveled off. Most experts agree, however, that it can be further reduced. This study focuses on the human factors aspects that

have consistently played a prominent role in mishap causation but only recently have received significant scrutiny. The approach taken in this study has as its premise that both the environment and the organism bring with them a certain degree of mishap potential and that a mishap occurs as a result of the additive effects, or critical interfaces, of the two. Determining these critical interfaces by retrospective analysis of past mishaps is the method used here, the immediate goal being to identify more clearly the root cause of human factors mishaps. Recommendations are offered for future efforts to avoid these critical interfaces or to decrease the mishap potential inherent in the environment and the organism. GRA

N80-31372# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Vertical Equipment Div.
COMPUTER SIMULATION OF EJECTION SEAT PERFORMANCE AND PRELIMINARY CORRELATION WITH EMPIRICAL DATA Final Technical Report, 1 Oct. 1977 - 1 Feb. 1979
Lanny A. Jines Apr. 1980 78 p refs
(AF Proj. 2402)
(AD-A087275; AFFDL-TR-79-3150) Avail: NTIS HC A05/MF A01 CSCL 01/3

The comparison of six-degree-of-freedom computer program modeling ejection seat performance to empirical data from ejection seat track tests is discussed. The computer subroutines model the ejection seat components which generate forces on the seat and crewperson combination during ejection. The resulting motion described in terms of trajectory parameters, as well as acceleration time histories on the ejectee is correlated with measured data from recent Air Force track test programs in which ejection seat performance was determined. GRA

N80-31373# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
MEDICAL AND TOXICOLOGICAL FACTORS IN AIRCRAFT ACCIDENTS
William R. Kirkham Apr. 1980 12 p refs Presented at the 14th Ann. Southern Methodist Univ. Air Law Symp., Dallas, 6-8 Mar. 1980
(AD-A087690; FAA-AM-80-6) Avail: NTIS HC A02/MF A01 CSCL 01/2

A number of factors operating within pilots may impair their ability to operate aircraft in a safe manner, thus accounting for some of the 83 to 87 percent of pilot 'causes' of general aviation accidents. Aircraft accident investigators should be attuned to characteristics of the accident, witness statements, and autopsy and laboratory findings that may suggest partial or complete incapacitation in the pilot. Incapacitation may be brought on by a medical condition which may be revealed at autopsy or be inferred only from medical history. Spatial disorientation is a subjective evaluation only and a form of incapacitation rated as the third most frequent 'cause' of fatal general aviation accidents. Lack of oxygen--hypoxia--is a constant threat to incapacitate in aircraft operating at high altitudes. Toxicological factors such as alcohol, drugs, and gases (e.g., carbon monoxide) should always be sought in fatal aircraft accidents by obtaining blood, urine and other specimens for laboratory analyses. Aerial application pilots may be incapacitated by the poisonous materials they apply, especially the cholinesterase-inhibiting insecticides. The finding of therapeutic drugs in the blood or other specimens from accident victims, or of tablets, pills, etc., at the scene, may point to underlying medical conditions that may impair pilot performance. The author discusses these principles and illustrates them briefly with cases to make accident investigators and others aware of the importance of medical and toxicological factors in aircraft accidents. GRA

N80-31374# Desmatics, Inc., State College, Pa.
A GENERAL STATISTICAL APPROACH FOR USING AUXILIARY INFORMATION IN THE DEVELOPMENT OF AN IMPACT ACCELERATION INJURY PREDICTION MODEL
John J. Peterson and Dennis E. Smith Aug. 1980 24 p refs
(Contract N00014-79-C-0128)
(AD-A087810; TR-112-6) Avail: NTIS HC A02/MF A01 CSCL 01/2

This report discusses general procedures for simultaneously incorporating various sources of auxiliary information into an impact acceleration injury prediction model. The sources of auxiliary information considered are supplemental continuous empirical data and a priori knowledge in the form of model parameter estimates and constraints. GRA

N80-31312# Piper Aircraft Corp., Lockhaven, Pa.
GENERAL AVIATION ICING FLIGHT TEST
William H. Lawton *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67
(For primary document see N80-31305 22-01)
Avail: Issuing Activity

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-31375*# Lockheed Aircraft Corp., Burbank, Calif.
DEVELOPMENT OF ADVANCED AVIONICS SYSTEMS APPLICABLE TO TERMINAL-CONFIGURED VEHICLES Final Report, Oct. 1978 - Jan. 1980
R. L. Heimbold, H. P. Lee, and M. F. Leffler Sep. 1980 105 p refs
(Contract NAS1-15546)
(NASA-CR-3280; LR-29326) Avail: NTIS HC A06/MF A01 CSCL 01D

A technique to add the time constraint to the automatic descent feature of the existing L-1011 aircraft Flight Management System (FMS) was developed. Software modifications were incorporated in the FMS computer program and the results checked by lab simulation and on a series of eleven test flights. An arrival time dispersion (2 sigma) of 19 seconds was achieved. The 4 D descent technique can be integrated with the time-based metering method of air traffic control. Substantial reductions in delays at today's busy airports should result. S.F.

N80-31376# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
IN-FLIGHT EVALUATION OF A SEVERE WEATHER AVOIDANCE SYSTEM FOR AIRCRAFT Final Report
Robert K. Baum and Timothy J. Seymour May 1980 128 p refs
(Contract FAA/ARD-740)
(AD-A087426; AFWAL-TR-80-3022) Avail: NTIS HC A07/MF A01 CSCL 01/2

Since there is increased interest in severe weather avoidance systems to augment conventional radar, a joint flight program was undertaken to evaluate the Ryan Stormscope as a thunderstorm avoidance tool. Comparisons were made between Stormscope electrical activity areas and precipitation contours from both on-board and ground weather radar displays. Strongest correlation between radar and Stormscope was found in regions of high precipitation gradients. Comparisons were also made between Stormscope and a ground-based Lightning Detection and Ranging System (LDAR) to determine range and azimuth accuracy of the electrical activity displayed on Stormscope. Because of inherent differences among these systems (i.e., type and rate of data acquisition), corresponding groups of electrical activity areas were compared. Items compared were group area ratios, group overlap areas and group centroid locations. In general, Stormscope groups were larger than corresponding LDAR groups (150% on the average). Additionally, Stormscope group centroid locations differed an average of 15 NM in range and 11 deg in azimuth from those on the LDAR system. This margin of error is acceptable for in-flight thunderstorm avoidance. GRA

N80-31377# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.
BALLOON-SUPPORTED LORAN ANTENNA, NEW HARD-

WARE FOR TETHERED BALLOONS, AND PAYLOADS USED IN BAMM FLIGHTS Final Report, 1 Nov. 1976 - 31 Dec. 1979
Alvin H. Howell Hanscom AFB, Mass. AFGL 28 Feb. 1980 14 p
(Contract F19628-77-C-0047; AF Proj. 6665)
(AD-A087487; AFGL-TR-80-0043) Avail: NTIS HC A02/MF A01 CSCL 17/9

Analysis of corona losses on a proposed balloon-supported loran antenna pointed the way to a workable design that was fully implemented and given an operational test. By-products of the antenna work included the production of a smart valve and useful new hardware for tethered balloons. Payloads were prepared for and used in three successful data-gathering balloon flights for the Balloon Altitude Mosaic Measurements program. GRA

N80-31378# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.
BALLOON-SUPPORTED ANTENNA FOR LORAN C/D NAVIGATION SYSTEM
Alvin H. Howell Jan. 1980 22 p
(Contract F19628-77-C-0047; AF Proj. 6665)
(AD-A087488; AFGL-TR-80-0107; SR-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

Analysis of corona losses on a proposed balloon-supported Loran antenna indicated the planned design could not be operated at full voltage because losses would far exceed the available power. This study, and a comparison study of expected corona loss on the operational antenna, pointed the way to a successful design. Special top-loader-tethers were procured, and essential hardware was built to implement the design. Electrical constants were measured in a launch test, after which interface hardware was produced for an operational test that was carried out at Anniston, Alabama. GRA

N80-31379# Dayton Univ., Ohio. Management Science.
LANDING SYSTEM RELIABILITY AND SAFETY MODEL Final Report, Sep. 1974 - Jun. 1979
L. Fudge, L. Gephart, and G. Yingling Wright-Patterson AFB, Ohio AFFDL Aug. 1979 179 p refs
(Contract F33615-74-C-3075; AF Proj. 2403; AF Proj. 2187)
(AD-A087524; AFFDL-TR-79-3107) Avail: NTIS HC A09/MF A01 CSCL 01/2

A total systems analysis procedure for identifying the safety hazards and risks associated with the use of a defined flight control system for low visibility approach and landing (Category 3) was developed. The analysis includes the ground transmitting system, airborne automatic flight control system, pilot and copilot operating in the system, and crew procedures. Actual data from Category 3 experience in a specially equipped C-141 aircraft, along with equipment failure data from C-141 fleet experience was used to test and confirm the modeling techniques. GRA

N80-31380# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
A SIMULATION INVESTIGATION ON THE FEASIBILITY OF CURVED APPROACHES UNDER MICROWAVE LANDING SYSTEM (MLS) GUIDANCE
L. J. J. Erkelens 20 Sep. 1978 101 p refs Revised
(Contract RB-RLD-1978-2.4)
(NLR-TR-78035-U) Avail: NTIS HC A06/MF A01

A flight simulator was used to investigate the utility of seven laterally curved approaches with various turn angles and final intercept altitudes, executed with a B-747 aircraft. Three weather situations were included, with winds of 15 m/sec and wind shears of 0.17 m sec/m. A minimum cloud base of 30.5 m was used. A flight director operating in the instrument landing system tracking mode and supplied with minor modifications in the roll bar drive was used as primary guidance instrument. Additional provisions were made to enable the pilot to monitor the approach. It was found that curved approaches with turn angles up to 180 deg can be carried out safely provided that the turn completion altitude is not much less than 305 m. Special provisions are needed with respect to the autopilot/flight director drive to achieve accurate tracking on the curved segment in strong wind conditions. Author (ESA)

N80-31308# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE TORNADO ALL-WEATHER HIGH-SPEED LOW-LEVEL SYSTEM
Ludwig Obermeier *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 22-36 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31341# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
PERFORMANCE OF NAVIGATION SYSTEMS
Karlheinz Hurrass *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-31381*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FLOW VISUALIZATION STUDY OF THE HiMAT RPRV
Dale J. Lorincz Feb. 1980 73 p refs Original contains color illustrations
(Contract NAS4-2616)
(NASA-CR-163094; NOR-80-128) Avail: NTIS HC A04/MF A01 CSCL 01C

Water tunnel studies were performed to qualitatively define the flow field of the highly maneuverable aircraft technology remotely piloted research vehicle (HiMAT RPRV). Particular emphasis was placed on defining the vortex flows generated at high angles of attack. The flow visualization tests were conducted in the Northrop water tunnel using a 1/15 scale model of the HiMAT RPRV. Flow visualization photographs were obtained for angles of attack up to 40 deg and sideslip angles up to 5 deg. The HiMAT model was investigated in detail to determine the canard and wing vortex flow field development, vortex paths, and vortex breakdown characteristics as a function of angle of attack and sideslip. The presence of the canard caused the wing vortex to form further outboard and delayed the breakdown of the wing vortex to higher angles of attack. An increase in leading edge camber of the maneuver configuration delayed both the formation and the breakdown of the wing and canard vortices. Additional tests showed that the canard vortex was sensitive to variations in inlet mass flow ratio and canard flap deflection angle. T.M.

N80-31382*# Sikorsky Aircraft, Stratford, Conn.
BIFILAR ANALYSIS STUDY, VOLUME 1
W. Miao and T. Mouzakis Aug. 1980 89 p refs
(Contract NAS1-15612)
(NASA-CR-159227; SER-510035-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01C

A coupled rotor/bifilar/airframe analysis was developed and utilized to study the dynamic characteristics of the centrifugally tuned, rotor-hub-mounted, bifilar vibration absorber. The analysis contains the major components that impact the bifilar absorber performance, namely, an elastic rotor with hover aerodynamics, a flexible fuselage, and nonlinear individual degrees of freedom for each bifilar mass. Airspeed, rotor speed, bifilar mass and tuning variations are considered. The performance of the bifilar absorber is shown to be a function of its basic parameters: dynamic mass, damping and tuning, as well as the impedance of the rotor hub. The effect of the dissimilar responses of the individual bifilar masses which are caused by tolerance induced mass, damping and tuning variations is also examined. T.M.

N80-31383*# Sikorsky Aircraft, Stratford, Conn.
BIFILAR ANALYSIS USERS MANUAL, VOLUME 2
Sebastian J. Cassarino Aug. 1980 366 p refs

(Contract NAS1-15812)
(NASA-CR-159228-Vol-2; SER-510036) Avail: NTIS HC A16/MF A01 CSCL 01C

The digital computer program developed to study the vibration response of a coupled rotor/bifilar/airframe coupled system is described. The theoretical development of the rotor/airframe system equations of motion is provided. The fuselage and bifilar absorber equations of motion are discussed. The modular block approach used in the make-up of this computer program is described. The input data needed to run the rotor and bifilar absorber analyses is described. Sample output formats are presented and discussed. The results for four test cases, which use the major logic paths of the computer program, are presented. The overall program structure is discussed in detail. The FORTRAN subroutines are described in detail. T.M.

N80-31384*# Lockheed-Georgia Co., Marietta.
EVALUATION OF LAMINAR FLOW CONTROL SYSTEM CONCEPTS FOR SUBSONIC COMMERCIAL TRANSPORT AIRCRAFT Summary Report
Sep. 1980 100 p refs
(Contract NAS1-14631)
(NASA-CR-159254; LG80ER0149) Avail: NTIS HC A05/MF A01 CSCL 01C

A study was conducted to evaluate alternatives in the design of laminar flow control (LFC) subsonic commercial transport aircraft for operation in the 1980's period. Analyses were conducted to select mission parameters and define optimum aircraft configurational parameters for the selected mission, defined by a passenger payload of 400 and a design range of 12,038 km (6500 n mi). The baseline aircraft developed for this mission was used as a vehicle for the evaluation and development of alternative LFC system concepts. Alternatives were evaluated in the areas of aerodynamics structures, materials, LFC systems, leading-edge region cleaning and integration of auxiliary systems. Based on these evaluations, concept in each area were selected for further development and testing and ultimate incorporation in the final study aircraft. Relative to a similarly-optimized advanced technology turbulent transport, the final LFC configuration is approximately equal in direct operating cost but provides decreases of 8.2% in gross weight and 21.7% in fuel consumption. Author

N80-31385*# National Aeronautics and Space Administration, Washington, D. C.
WING PROFILE DESIGN OF THE WORLD CHAMPIONSHIP SAIL PLANE SB 11
K. H. Horstmann and A. Quast May 1980 9 p Transl. into ENGLISH from DFVLR-Nachr. (West Germany), Nov. 1979 p 19-20 Original language document announced as A80-13181 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-75829) Avail: NTIS HC A02/MF A01 CSCL 01C

A glider capable of climbing while circling in an updraft at low speed with a great mount of lift while gliding to the next updraft at high speed and with minimal altitude loss was designed. The wing profile design alleviates several problems and leaves no gap between wind and flap. A constant thickness flap eliminates the need for a flexible contour section which in turn reduces control effort. The conventional method of banking with ailerons is retained. Improved performance is demonstrated. S.J.

N80-31386*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON OF CALCULATED AND MEASURED BLADE LOADS ON A FULL-SCALE TILTING PROPROTOR IN A WIND TUNNEL
Wayne Johnson Sep. 1980 22 p Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TM-81228; USAAVRADCOM-TR-80-A-8) Avail: NTIS HC A02/MF A01 CSCL 01C

The loads measured in a wind tunnel on a full-scale tilting proprotor are compared with calculated results. The data consists primarily of oscillatory beamwise bending moments at 35% radial station, oscillatory spindle chord bending moments, and oscillatory pitch link loads. The measured and calculated results as a function of thrust are compared over a range of nacelle angles from 0 to 75 deg, and a range of speeds from 80 to 185 knots.T.M.

N80-31387*# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
PROGRESS REPORT 3 OF COOPERATIVE PROGRAM FOR DESIGN, FABRICATION, AND TESTING OF HIGH MODULUS COMPOSITE HELICOPTER SHAFTING Final Report, 1 Jan. 1975 - 30 Jun. 1979
Charles C. Wright (AARADCOM, Dover, N.J.) and Donald J. Baker Jun. 1980 139 p refs
(DA Proj. 1T1-62105-A-331)
(NASA-TM-82272; AD-A086849; AD-E400434; ARLCD-TR-79028) Avail: NTIS HC A07/MF A01 CSCL 11/4

This report describes the third phase of work, the objective of which was to overcome the excessive brittleness of the previously developed UH-1 helicopter tail rotor drive shaft design which demonstrated a shaft train weight savings of 53.1% over the current 2024-T3 aluminum shaft train. A materials impact program demonstrated exceptionally noteworthy performance of two woven constructions containing E-glass and PRD 49-III (designation later changed to KEVLAR 49) fibers in an epoxy resin matrix. Thermoplastic matrices and PRD 49-III fiber provided impact resistance at low weight which was superior to composites having the same fiber in a thermoset resin matrix. A design, fabrication, and test program showed that shaft impact resistance could be improved over the previously developed graphite composite design at a cost in shaft train rate savings. The shaft train weight savings of the most impact tolerant construction was 4.0% over the current aluminum shaft train. Alternating plies of graphite and glass appear to provide substantially greater tube impact durability than that provided by hybridization of the two fibers into one tape wound to a ply design equivalent in strength and stiffness to that of the alternating ply design. Recommendations were made to continue research work to exploit the potential for more impact-durable structures through the use of KEVLAR 49 fiber, woven structures, thermoplastic matrices and THORNEL 50-S/KEVLAR 49 blends with thermoset matrices. GRA

N80-31388# Naval Ship Research and Development Center, Bethesda, Md.
REMOTELY PILOTED SEAPLANE FOR ANTISUBMARINE WARFARE Final Report
C. Joseph Martin and Basil Papadales, Jr. Jul. 1980 27 p refs Presented at the Advan. Concepts Workshop in ASW Weapon Systems, San Diego, Calif., 7-9 Aug. 1979
(NF41421091)
(AD-A086932; DTNSRDC-80/078; DTNSRDC-Aero-1267) Avail: NTIS HC A03/MF A01 CSCL 01/3

The remotely piloted seaplane (RPS) for antisubmarine warfare (ASW) is a small, relatively inexpensive, unmanned water-based aircraft that provides excellent time-on-station performance, tactical flexibility, and energy efficiency. In the 1980's, command, control, and communications (C3) technology will be available which will permit a seaplane to be designed with no crew on board. Such a vehicle would be capable of performing military ASW operations in open ocean areas while taking full advantage of its waterborne capability. The removal of a crew from the seaplane has a substantial impact on the aircraft design. A RPS having a 1200 n mi radius of action and 72 hr time-on-station would weigh only 34,800 lb (15,764 kgm) and would incorporate a 5300 lb (2400 kg) ASW payload. GRA

N80-31389# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DETERMINATION OF THE CHARACTER OF THE LATERAL-DIRECTIONAL MOTION OF AN AIRBORNE TOWED VEHICLE
H. George Baroff 30 Apr. 1980 30 p refs
(WF11124704)
(AD-A087445; NADC-80037-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report presents the derivation of the lateral directional equations of motion of an airborne towed vehicle. Herein it is assumed that the tow cable is stable and is attached to the vehicle at other than its center of gravity. In addition to

customary airborne vehicle equations of motion, the lateral rotation rate of the cable attachment point on the vehicle is described as a function of cable length. Components of cable tension are included in the equations. Determinations of the character of the lateral directional motion of a HTM-11 and a modified HTM-11 towed vehicles employing the developed equations of motion are discussed. GRA

N80-31390# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEMS DYNAMIC ANALYSIS COMPONENT DATA HANDBOOK Final Technical Report, 1 Jun. 1978 - Nov. 1979
Roy Deshazer, Roy Levek, Mike Stevens, and Bob Young Wright-Patterson AFB, Ohio Apr. 1980 100 p refs
(Contract F33615-78-C-2026; AF Proj. 3145)
(AD-A087366; AFWAL-TR-80-2040) Avail: NTIS HC A05/MF A01 CSCL 01/3

The component data handbook has been developed to aid users of the aircraft hydraulic system dynamic analysis computer programs HSFR, SSFAN, and HYTRAN in selecting input data. The handbook provides brief descriptions of the general usage components modeled by these computer programs, tabulates the necessary input data for each program and catalogs typical data trends or actual input data of components that have been simulated. GRA

N80-31391# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
HELICOPTER-SHIP QUALIFICATION TESTING
L. T. Renirie and T. Hoekstra 3 Jul. 1979 16 p refs Presented at 5th European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep., 1979
(NLR-MP-79027-U) Avail: NTIS HC A02/MF A01

A test method was developed for establishing limits for helicopter takeoff and landing imposed by turbulence and flight deck motion. An onboard recorder monitors the helicopter engine parameters, collective pitch lever position, pedal position, radar altitude, vertical and lateral acceleration, and instant of takeoff and landing. Onboard ship, relative wind speed and direction, pitching and rolling angles, and vertical and lateral acceleration are recorded. To quantify the human factors in controlling the helicopter a pilot rating technique is applied. It was found that operational limits for the helicopter in terms of relative wind speed and direction can be established straightforwardly. With respect to ship motion, it was found satisfactory to use the 2 sigma value of motion parameters as a representative measure to define limits. Wind tunnel tests of ship models are described. Author (ESA)

N80-31392# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
SIGNIFICANCE OF A ROTOR BLADE FAILURE FOR FLEET OPERATION, INSPECTION, MAINTENANCE, DESIGN AND CERTIFICATION
R. J. H. Wanhill, E. A. B. deGraaf, and A. A. M. Delil Sep. 1979 16 p refs Presented at 5th European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep. 1979
(NLR-MP-79021-U) Avail: NTIS HC A02/MF A01

The catastrophic fracture of a rotor blade from a large helicopter was analyzed, with essentially immediate consequences for continued fleet operation, inspection and maintenance of the same type of rotor blade. Fractography indicated that the hollow blade spar had failed by fatigue originating from one or two corrosion pits under the spar/pocket joint. The service failure investigation was reviewed to serve as an essential illustration for subsequent discussion of remedial action for similar types of rotor blades, and design aspects, philosophy and procedure. This includes the adhesive bonding system, the pressurizing gas crack detection system, rotor blade working stresses, and estimation of fatigue initiative and crack growth lives. Author (ESA)

N80-31393# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
MANEUVER SPECTRUM FATIGUE CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS
R. J. H. Wanhill 14 May 1980 34 p refs
(Contract RNLAF-Klu-RE-1977.c14)
(NLR-TR-78091-U) Avail: NTIS HC A03/MF A01

Aluminum alloy sheets of 2024-T3, 2048-T851, 7075-T6 and 7475-T761, were compared for fatigue crack propagation resistance under maneuver spectrum and constant amplitude loading. For maneuver spectrum loading 7475-T761 was superior overall, probably due to toughness of this alloy. Alloy 2024-T3 was superior for lower stress levels and lower crack growth rates with maneuver spectrum loading and for lower delta K values with constant amplitude loading, while 7475-T761 was superior for higher crack growth rates and higher stress levels with maneuver spectrum loading and for higher delta K values with constant amplitude loading. Author (ESA)

N80-31394# Aircraft Research Association Ltd., Bedford (England).
THE DESIGN OF AXISYMMETRIC COWLS FOR PODDED NACELLES FOR HIGH BY-PASS RATIO TURBOFAN ENGINES
M. J. Langley London Aeronautical Research Council May 1979 81 p refs Supersedes ARA-54; ARC-38204
(ARC-R/M-3846; BR74570; ARA-54; ARC-38204) Avail: NTIS HC A05/MF A01; HMSO £14 PHI

The design and test of forecowl profiles for a podded engine nacelle of modern proportions, with the specific aim of obtaining favorable supercritical flow development over the cowl exterior is described. Six cowl shapes were tested, exploiting the pressure distribution principle previously evolved for high speed airfoils. Features of the measured surface pressure distributions over the cowls were related to the occurrence of drag rise, from either increase of Mach number or decrease of flow ratio (spillage). The level of high speed drag performance reached by the best cowl designs tested was equivalent to or slightly better than the corresponding optimum NACA 1-series cowl, superiority at low speed being retained throughout. Author (ESA)

N80-31395# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF THE USE OF BLOCKING MASSES IN REDUCING HELICOPTER CABIN NOISE
C. H. Ellen (Imperial Coll.) London HMSO Mar. 1980 23 p refs
(RAE-TM-Aero-1838; BR73588) Avail: NTIS HC A02/MF A01

A brief theoretical examination of the use of blocking masses for application to helicopter structure is presented. The effects of a periodic array of blocking masses are compared with the effect of a single blocking mass for a bending wave on a plate. The significance of the modal structure is demonstrated, and the analysis of the excitation of a membrane strip at a point between two blocking masses is used to illustrate how the energy flow varies with frequency of excitation. Author (ESA)

N80-31306# McDonnell-Douglas Corp., St. Louis, Mo.
F/A-18 STATUS REPORT
John E. Krings *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31307# Fairchild Republic Co., Farmingdale, N. Y.
NIGHT/ADVERSE WEATHER A-10 EVALUATOR PROGRAM (A-10B)
Wendell H. Shawler *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p10-21 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31309# Air Force Flight Test Center, Edwards AFB, Calif.
F-16 EUROPEAN TEST AND EVALUATION
Thomas P. McAtee and Loren Timm *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 37-51 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31310# McDonnell-Douglas Corp., St. Louis, Mo.
YAV-8B STATUS REPORT
Charles A. Plummer, Jr. *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980

p 52-59 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31311# Air Force Flight Test Center, Edwards AFB, Calif.
HAVE BOUNCE
Richard A. Borowski *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA)
James L. Martin *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 77-93 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 01C

N80-31315# Rockwell International Corp., Pittsburgh, Pa.
SABRELINER 65
William R. Yoakley *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 119-122 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31316# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE DEVELOPMENT OF THE WORLD'S FIRST TRIENGINE BUSINESS JET, THE MYSTERE FALCON 50
Jerome A. Resal *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 23-137 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31317# Canadair Ltd., Montreal (Quebec).
CL-600 CHALLENGER
E. D. Adkins *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 138-144 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31318# Society of Experimental Test Pilots, Lancaster, Calif.
P-59
Laurence C. Craigie *In its* Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 147-165 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31319# McDonnell-Douglas Corp., St. Louis, Mo.
AIRCRAFT WINGTIP COUPLING EXPERIMENTS
C. E. Anderson *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 166-184 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31321# Air Force Flight Test Center, Edwards AFB, Calif.
REVIEW OF FIVE YEARS OF FLIGHT TESTING THE B-1
John S. Smith, III and Frederick A. Fiedler *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 209-231 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31322# Aerotron, Inc., Bennington, Vt.
CROSSING THE CHANNEL IN THE GOSSAMER ALBATROSS
Paul Macready *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 232-243 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31327# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
OPTIMIZATION OF THE MATHEMATICAL MODEL OF A STRUCTURE
Helmut Zimmerman *In* AGARD Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980 p 1-14 refs (For primary document see N80-31326 22-01)
Avail: NTIS HC A03/MF A01

N80-31330# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
SOME COMMENTS ON THE PROBLEMS INVOLVED IN AIRCRAFT ASSESSMENT AND ACCEPTANCE TESTING
J. F. Renaudie *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 26 p ref (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31331# Air Force Flight Test Center, Edwards AFB, Calif.
USAF DEVELOPMENT TEST AND EVALUATION
Laurence P. Colburn *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 13 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31332# British Aerospace Aircraft Group, Dunsfold (England).
SOME EXAMPLES OF PROCEDURES USED IN UK FOR ACCEPTANCE TESTING OF AIRCRAFT PRODUCED BY THE AIRCRAFT INDUSTRY UNDER GOVERNMENT CONTRACT
R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31334# Air Force Flight Test Center, Edwards AFB, Calif.
PERFORMANCE TESTING PRODUCTION AIRLINES
Roger C. Crane *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 27 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31337*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT RESEARCH TECHNIQUES UTILIZING REMOTELY PILOTED RESEARCH VEHICLES
R. Dale Reed *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 15 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31338# Air Force Flight Test Center, Edwards AFB, Calif.
QUALITATIVE ARMAMENT SUBSYSTEM ASSESSMENT
Lawrence P. Colburn *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation and 35 Instrumentation and Photography.*

N80-31396 Old Dominion Univ., Norfolk, Va.
ANALYTIC AND EXPERIMENTAL STUDIES OF A TRUE *AIRSPEED SENSOR Ph.D. Thesis*
Joseph Yao-Cheng Shen 1980 203 p
Avail: Univ. Microfilms Order No. 8019959

The analysis and design of a true airspeed sensor is described. In an attempt to model the complicated fluid mechanics of the vortex precession, three dimensional, inviscid, unsteady, incompressible fluid flow was studied by using the hydrodynamical linearized stability theory. The results show that the frequency response is linearly proportional to the airspeed. The designed sensor basically consists of a vortex tube, a swirler, and a pick up system. When air passed through the swirler, a precessional flow was generated at the region before and after the sudden enlargement area. Also an audible vortex whistle is generated. The signal is picked by the microphone and the frequency response is shown in a frequency counter. The measurement for both

closed conduit tests and wind tunnel tests were recorded. A computer program was developed for obtaining the numerical solution to the theoretical model. Computational results for various combinations of vortex tubes and swirlers have been obtained. Dissert. Abstr.

N80-31397*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PERCEPTION OF AIRCRAFT SEPARATION WITH PILOT-PREFERRED SYMBOLOGY ON A COCKPIT DISPLAY OF TRAFFIC INFORMATION

Sharon OConnor (San Jose State Univ.), Sharon Jago (San Jose State Univ.), Daniel Baty, and Everett Palmer Sep. 1980 16 p refs

(Grant NsG-2269)

(NASA-TM-81172; A-8107) Avail: NTIS HC A02/MF A01 CSCL 01D

The concept of a cockpit display of traffic information (CDTI) was developed for use in later full mission simulator evaluations of the CDTI concept. Pilots chose their preferred method of displaying air traffic information for several variables. Variables included: type of background, update rate, update type, predictor type, and history type. Each pilot designed a display he felt would be most useful in flight operations. After a series of test trials, each pilot was given the opportunity to modify the display for the experimental task. For a second day of testing, they repeated the experimental task using their display as well as displays chosen by other pilots. Results indicated a variety of individual preferences in symbology and differences in the accuracy of judgments. Pilots indicated concern for clutter of the display, relationship of the displayed symbology to physical reality, and a need to perceive the relative motion of the intruder aircraft. Analysis of data indicated that pilots were able to improve their performance with practice. R.K.G.

N80-31333# Societe de Fabrication d'Instruments de Mesure SFIM, Massy (France). Measurement and Recording Div.

A REVIEW OF FLIGHT TEST INSTRUMENTATION SYSTEMS FOR ACCEPTANCE TESTING OF THE PRODUCTION AIRCRAFT

Claude Robert *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 3 p (For primary document see N80-31329 22-01)

Avail: NTIS HC A09/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-31398*# TRW, Inc., Cleveland, Ohio. Materials Technology.

COST ANALYSIS OF COMPOSITE FAN BLADE MANUFACTURING PROCESSES Final Report

T. S. Stelson and C. F. Barth Jun. 1980 87 p refs

(Contract NAS3-21352)

(NASA-CR-159876; TRW-ER-8064) Avail: NTIS HC A05/MF A01 CSCL 21E

The relative manufacturing costs were estimated for large high technology fan blades prepared by advanced composite fabrication methods using seven candidate materials/process systems. These systems were identified as laminated resin matrix composite, filament wound resin matrix composite, superhybrid solid laminate, superhybrid spar/shell, metal matrix composite, metal matrix composite with a spar and shell, and hollow titanium. The costs were calculated utilizing analytical process models and all cost data are presented as normalized relative values where 100 was the cost of a conventionally forged solid titanium fan blade whose geometry corresponded to a size typical of 42 blades per disc. Four costs were calculated for each of the seven candidate systems to relate the variation of cost on blade size. Geometries typical of blade designs at 24, 30, 36 and 42 blades per disc were used. The impact of individual process yield factors on costs was also assessed as well as effects of process parameters, raw materials, labor rates and consumable items. A.R.H.

N80-31399*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REVERSE THRUST PERFORMANCE OF THE OCSEE VARIABLE PITCH TURBOFAN ENGINE

N. E. Samanich, D. C. Reemsnyder, and H. E. Blodmer 1980 57 p refs Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engr.

(NASA-TM-81558; E-519) Avail: NTIS HC A04/MF A01 CSCL 21E

Results of steady state reverse and forward to reverse thrust transient performance tests are presented. The original quiet, clean, short haul, experimental engine four segment variable fan nozzle was retested in reverse and compared with a continuous, 30 deg half angle conical exiet. Data indicated that the significantly more stable, higher pressure recovery flow with the fixed 30 deg exiet resulted in lower engine vibrations, lower fan blade stress, and approximately a 20 percent improvement in reverse thrust. Objective reverse thrust of 35 percent of takeoff thrust was reached. Thrust response of less than 1.5 sec was achieved for the approach and the trakeoff to reverse thrust transients. Author

N80-31400*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN EXPERIMENTAL EVALUATION OF THE PERFORMANCE DEFICIT OF AN AIRCRAFT ENGINE STARTER TURBINE

Jeffrey E. Hass, Richard J. Roelke, and Paul Hermann (Sunstrand Corp., Rockford, Ill.) 1980 21 p ref Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engr.

(NASA-TM-81571; E-539) Avail: NTIS HC A02/MF A01 CSCL 21E

An experimental investigation was made to determine the reasons for the low aerodynamic performance of a 13.5 centimeter tip diameter aircraft engine starter turbine. The investigation consisted of an evaluation of both the stator and the stage. An approximate ten percent improvement in turbine efficiency was obtained when the honeycomb shroud over the rotor blade tips was filled to obtain a solid shroud surface. Author

N80-31401*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE NASA HIGH-SPEED TURBOPROP PROGRAM

James F. Dugan, Brent A. Miller, Edwin J. Graber, and David A. Sagerser 1980 48 p refs Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by the Am. Soc. of Automotive Engr.

(NASA-TM-81561; E-452) Avail: NTIS HC A03/MF A01 CSCL 01C

Technology readiness for Mach 0.7 to 0.8 turboprop powered aircraft with the potential for fuel savings and DOC reductions of up to 30 and 15 percent respectively relative to current in-service aircraft is addressed. The areas of propeller aeroacoustics, propeller structures, turboprop installed performance, aircraft cabin environment, and turboprop engine and aircraft studies are emphasized. Large scale propeller characteristics and high speed propeller flight research tests using a modified testbed aircraft are also considered. J.M.S.

N80-31402*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPROVED COMPONENTS FOR ENGINE FUEL SAVINGS

Robert J. Antl and John E. McAulay 1980 33 p refs Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engr.

(NASA-TM-81577; E-506) Avail: NTIS HC A03/MF A01 CSCL 21E

The Engine Component Improvement (ECI) Project formulated to address near term improvements for current engines is described with emphasis on the development of component technologies to reduce the fuel consumption of CF6, JT9D, and JT8D engines. The technical and economical acceptability and the fuel saving

potential of nine concepts are demonstrated. Descriptions of these concepts, results of testing, and the status as to entering airline service are presented. Also presented is the status of the remaining concepts still under development. J.M.S.

N80-31403# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED TECHNOLOGY COMPONENTS FOR MODEL GTP305-2 AIRCRAFT AUXILIARY POWER SYSTEM Final Report, 6 May 1975 - 15 Jul. 1979
James R. Kidwell and Gerold D. Large Wright-Patterson AFB, Ohio AFWAL Feb. 1980 538 p
(Contract F33615-75-C-2016; AF Proj. 3145)
(AD-A087838; AFAPL-TR-79-2106) Avail: NTIS HC A23/MF A01 CSCL 10/2

The GTP305-2 Advanced APU is a single shaft, all shaft power engine incorporating an axial-centrifugal compressor, a reverse flow annular combustor and a radial-axial turbine. Cycle analyses indicated a 10 percent high pressure compressor flow increase improved matching characteristics with the low pressure compressor. The combustion system is a reverse flow annular combustor with an air-assist/airblast fuel injection system. The radial-axial turbine stage is characterized by an integrally cast turbine rotor and a cast exhaust duct assembly. The Integrated Components Assembly (ICA) rig consists of the combustor and turbines with a dummy mass on the shaft to simulate the compressor. ICA testing was conducted to establish component performance at design operating conditions. ICA and cold air aerodynamic testing of the turbine stage and cooling flow effects, indicates design efficiency goals were exceeded. ICA test results, cold-air testing and combustion system parameters were input to the cycle model. Room temperature strain-control LCF tests were performed and results analyzed on a Weibull distribution. Data analysis indicated LCF life improvement was obtained through HIP and heat treatment. GRA

N80-31404# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
ENVIRONMENTAL TESTING OF COATINGS FOR GAS TURBINES
A. J. A. Mom 10 Jul. 1979 14 p refs Presented at 9th Intern. Thermal Spraying Conf., Gravenhage, Netherlands, 19-23 May 1980
(NLR-MP-79028-U) Avail: NTIS HC A02/MF A01

An environmental test chamber was built to analyze the effects of air pollutants on gas turbine materials and components. Engine conditions including temperature, stress, thermal cycling and gas velocity are reproduced. Actual components or test pieces are tested according to realistic mission profiles using a flight by flight test procedure. Good agreement was obtained between corrosion behavior in service and that in the test rig.
Author (ESA)

N80-31343# RAND Corp., Washington, D. C.
AN APPROACH TO THE LIFE CYCLE ANALYSIS OF AIRCRAFT TURBINE ENGINES
J. R. Nelson *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 27 p refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31344# Ministry of Defence, London (England).
DESIGN TO LIFE CYCLE COSTS INTERACTION OF ENGINE AND AIRCRAFT
E. J. Jones *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 15 p (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31345# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aeronautical Systems Div.
PROGRESS ON THE US AIR FORCE APPROACH FOR THE PRACTICAL MANAGEMENT OF ENGINE LIFE CYCLE COSTS
Richard E. Steere, Edward G. Koepnick, and Robert A. Dean *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 10 p refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31346# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
MILITARY ENGINE PROGRAMS WITH COST OBJECTIVES [PROGRAMMES DE MOTEURS MILITAIRE A OBJECTIES DE COUT]
Claude Foure *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 28 p *In FRENCH* (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31348# Rolls-Royce Ltd., Bristol (England). Aero Div.
THE APPLICATION OF DESIGN TO COST AT ROLLS-ROYCE
R. J. Symon and K. J. Dangerfield *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 17 p (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31349# Boeing Aerospace Co., Seattle, Wash. Systems Cost Analysis Div.
EVALUATING AND SELECTING THE PREFERRED AIR BREATHING WEAPON SYSTEM
Frank A. Watts *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 16 p (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-31405 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DESIGN OF AN ADAPTIVE CONTROL SYSTEM FOR THE EBF/STOL AIRCRAFT WITH PROVISIONS FOR EIGENVALUE AND EIGENVECTOR SELECTION Ph.D. Thesis
Jan W. Crane 1980 103 p
Avail: Univ. Microfilms Order No. 8020202

The design of an adaptive controller that is characterized by the ability to provide the designer with a means of selecting the closed-loop eigenvalues and shape each eigenvector is presented. The method generates the necessary constraints between the attainable eigenvalues and their eigenvectors. A least squares solution for the feedback gains is obtained from the remaining equations. The application of the procedure to the design of model following, state decoupling, and trajectory following controllers is accomplished by specifying the eigenvalues and eigenvectors of the final system. Also included in the controller is an on-line identifier for providing up to date information about the system and a control effector failure detector. The procedure has been applied to the design of controllers for the EBF/STOL aircraft. State decoupling and trajectory following controllers are designed and simulated. The simulation is performed without identification and with full knowledge of the system. A final simulation of the state decoupling controller is performed with the system identifier and the failure detector.
Dissert. Abstr.

N80-31406 Georgia Inst. of Tech., Atlanta.
GUST RESPONSE ANALYSIS BY MODAL DECOMPOSITION OF THE GUST IMPINGEMENT DISTRIBUTION Ph.D. Thesis
Frederick David Eichenbaum 1980 187 p
Avail: Univ. Microfilms Order No. 8018148

The mode impingement method which achieves a radical improvement in computational efficiency over the current panel method of multi-dimensional (2-D and 3-D) gust response analysis, is described. The mode impingement method employs an orthogonal decomposition of the gust impingement distribution to reduce a large number of statistically interdependent panel inputs to a small number of statistically independent impingement patterns or gust modes. Since the normalized gust modes are slowly varying functions of frequency, orthogonal decomposition need be performed only at the chosen interpolation frequencies

for which aerodynamic input data are furnished. Modal accuracy is then maintained throughout the interpolation interval by simple interpolation procedures. The small deficit in local gust amplitude resulting from exclusion of the higher modes is eliminated by a compensating adjustment in the local amplitude of the included gust modes. Results are compared with corresponding dynamic response flight test measurements and with alternative analysis techniques. Dissert. Abstr.

N80-31407*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF ROTOR PARAMETER VARIATIONS ON HANDLING QUALITIES OF UNAUGMENTED HELICOPTERS IN SIMULATED TERRAIN FLIGHT

Peter D. Talbot, Daniel D. Dugan, Robert T. N. Chen, and Ronald M. Gerdes Aug. 1980 88 p refs

(NASA-TM-81190; A-8158) Avail: NTIS HC A05/MF A01 CSCL 01C

A coordinated analysis and ground simulator experiment was performed to investigate the effects on single rotor helicopter handling qualities of systematic variations in the main rotor hinge restraint, hub hinge offset, pitch-flap coupling, and blade lock number. Teetering rotor, articulated rotor, and hingeless rotor helicopters were evaluated by research pilots in special low level flying tasks involving obstacle avoidance at 60 to 100 knots airspeed. The results of the experiment are in the form of pilot ratings, pilot commentary, and some objective performance measures. Criteria for damping and sensitivity are reexamined when combined with the additional factors of cross coupling due to pitch and roll rates, pitch coupling with collective pitch, and longitudinal static stability. Ratings obtained with and without motion are compared. Acceptable flying qualities were obtained within each rotor type by suitable adjustment of the hub parameters, however, pure teetering rotors were found to lack control power for the tasks. A limit for the coupling parameter L sub q/L sub p of 0.35 is suggested. Author

N80-31408*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

A SIMULATOR STUDY OF CONTROL AND DISPLAY AUGMENTATIONS FOR HELICOPTERS Final Report

J. C. Adamson, Gerardus J. Born, and Theodore A. Dukes Jan. 1980 104 p refs

(Contract NAS2-9437)

(NASA-CR-163451; AD-A087201; MAE-1428) Avail: NTIS HC A06/MF A01 CSCL 01/4

A fixed-based simulator study of a decelerating approach to hover on instruments was performed with five different control augmentation systems ranging from damping feedbacks to attitude command with heading-hold. On a CRT display the environment was simulated by the view of landing pad and the horizon. Superimposed on this image was all flight information needed, together with special symbology for self-contained landing aid based on airborne measurements only; there were a total of four display augmentation levels. Among other findings, the statistically significant differences in data obtained with six test pilots suggest that a relatively inexpensive addition to the display (i.e., quickening of an error rate vector with short term attitude information) makes up for the difference between rate command and attitude command control systems. A quantitative objective measure of improvements was found to suggest the major findings of the report. GRA

N80-31409# AiResearch Mfg. Co., Torrance, Calif.

ELECTROMECHANICAL ACTUATION DEVELOPMENT Final Report, 20 Sep. 1978 - 15 Dec. 1979

Robert A. Lewis, John Gray, and Neal E. Wood Feb. 1980 118 p refs

(Contract F33615-76-C-3043)

(AD-A085847; Rept-80-16763; AFWAL-TR-80-3024) Avail: NTIS HC A06/MF A01 CSCL 01/4

Electromechanical actuation of primary flight control surfaces has been demonstrated by the development of an integrated rotary hinge-line dual-redundant actuation unit. The controller power level of 30 amp at 270 vdc was demonstrated. Thermal characteristics of the motor and actuator were evaluated at ambient temperatures ranging from -65 F to 250 F. GRA

N80-31410# Aeronautical Research Labs., Melbourne (Australia).

WESSEX MODERNIZATION: A PRELIMINARY SIMULATION STUDY

Christopher R. Guy Apr. 1979 42 p refs

(AD-A087799; ARL/Aero-Note-391) Avail: NTIS HC A03/MF A01 CSCL 01/3

A preliminary simulation study for a modernized Wessex helicopter, proposed for use by the RAN, is presented. The study uses mathematical models of the Wessex Mk31B aerodynamics/kinematics and modified Sea King Mk50 flight control system to simulate the flight dynamic behavior of the modernized Wessex. Results indicate that good flight performance can be obtained provided system parameters are chosen correctly. GRA

N80-31411# Analytic Sciences Corp., Reading, Mass.

VALIDATION OF HIGH ANGLE-OF-ATTACK ANALYSIS METHODS Annual Technical Report, 1 Feb. 1977 - 31 Dec. 1978

Paul W. Berry, John R. Broussard, and Sol W. Gully 20 Sep. 1979 194 p refs

(Contract N00014-75-C-0432; NR Proj. 215-237)

(AD-A087621; TASC-TR-612-3; ONR-CR-215-237-3F) Avail: NTIS HC A09/MF A01 CSCL 01/3

This report extends, applies, and validates the aircraft stability and control methodologies developed by TASC and reported in ONR-CR-215-237-2. These methodologies enable the prediction of airframe stability boundaries, control and power difficulties, and stability boundaries of the combined pilot, control system, and aircraft. In the realm of control system design, these methods enable the construction of digital command augmentation systems which provide precise command response over the entire flight regime while augmenting the airframe stability characteristics. The design of an air combat digital flight control system for the F-14A is described in this report, and its performance is verified by the use of a nonlinear six degree-of-freedom aircraft simulation and an air combat pilot model. Comparison of the tracking accuracy of the DFCS aircraft to that of a conventionally controlled aircraft indicates that the DFCS provides better tracking and reduces the likelihood of control-induced departure. In the realm of pilot model validation, a method of choosing the best model among those hypothesized is described and its operation demonstrated. Piloted simulation data are processed which indicate that the pilot does not change his control strategy to correspond to changes in the aircraft flight condition. GRA

N80-31328# Aeritalia S.p.A., Torino (Italy).

EFFECTS OF NONLINEARITIES ON WING-STORE FLUTTER

G. DeFerrari, L. Chesta, O. Sensburg (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich), and A. Lotze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich) *In* AGARD Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980 p 15-32 refs (For primary document see N80-31326 22-01)

Avail: NTIS HC A03/MF A01

N80-31335# British Aerospace Aircraft Group, Dunsfold (England).

EVALUATION OF LONGITUDINAL CHARACTERISTICS INCLUDING STABILITY HANDLING AND CG RANGE

R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)

Avail: NTIS HC A09/MF A01

N80-31338# British Aerospace Aircraft Group, Dunsfold (England).

EVALUATION OF LATERAL AND DIRECTIONAL CHARACTERISTICS AND SPINNING BEHAVIOUR

R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 12 p refs (For primary document see N80-31329 22-01)

Avail: NTIS HC A09/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-31412# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE USE OF SIMULATORS FOR TRAINING IN-FLIGHT AND EMERGENCY PROCEDURES
Edward E. Eddowes (Air Force Human Resources Lab., Williams AFB, Arizona) and Wayne L. Waag (Air Force Human Resources Lab., Williams AFB, Arizona) Jun. 1980 39 p refs
(AGARD-AG-248; ISBN-92-835-1363-0) Avail: NTIS HC A03/MF A01

The nature of pilot skills is examined and a strategy for using flight simulators to acquire and maintain such skills is suggested. Salient characteristics of state-of-the-art simulators and the visual display system capabilities they provide for training contact flying tasks are described. Research on transfer of learning from simulator to aircraft in a variety of training tasks is reviewed. The use of simulators as aircraft substitutes and their integration within an array of ground training media are compared and contrasted to illustrate the cost effectiveness potential of these two approaches. The rationale for and the characteristics of a simulator oriented emergency procedures training program which emphasizes pilot decision making skills are presented. The development of aircrew performance measurement systems for use in evaluating, refining, and documenting simulator training effectiveness is reported. An interpretation of the impact of current developments on the future use of simulators is offered and a list of conclusions provided. E.D.K.

N80-31413*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT AND VALIDATION OF A HYBRID-COMPUTER SIMULATOR FOR A TRANSONIC CRYOGENIC WIND TUNNEL
Jerry J. Thibodeaux and S. Balakrishna (Old Dominion Univ.) Sep. 1980 84 p refs
(NASA-TP-1695; L-13691) Avail: NTIS HC A05/MF A01 CSCL 14B

A study was undertaken to model the cryogenic wind tunnel process, to validate the model by the use of experimental data from the Langley 0.3 Meter Transonic Cryogenic Tunnel, and to construct an interactive simulator of the cryogenic tunnel using the validated model. Additionally, this model was used for designing closed loop feedback control laws for regulation of temperature and pressure in the 0.3 meter cryogenic tunnel. The global mathematical model of the cryogenic tunnel that were developed consists of coupled, nonlinear differential governing equations based on an energy state concept of the physical cryogenic phenomena. Process equations and comparisons between actual tunnel responses and computer simulation predictions were examined. Also included are the control laws and simulator responses obtained using the feedback schemes for closed loop control of temperature and pressure were also included. R.C.T.

N80-31414# McDonnell Aircraft Co., St. Louis, Mo.
V/STOL EQUIVALENT SYSTEMS ANALYSIS Final Report, 27 Aug. 1979 - 27 May 1980
Carl G. Carpenter and John Hodgkinson Mar. 1980 225 p refs
(Contract N62269-79-C-0700)
(AD-A087283; NADC-79141-60) Avail: NTIS HC A10/MF A01 CSCL 01/3

A fixed base manned V/STOL handling qualities simulation was performed to answer questions concerning: (1) the pilot's frequency range of interest, (2) the maximum allowable mismatch between high order systems and their low order equivalents, (3) acceptability of high order appearing responses and (4) the piloting effects of phase lag at the natural frequency versus time delay. Various high or low frequency terms were added to low order attitude systems. Pilot ratings and comments showed that the pilot's frequency range of interest was .5-4.0 rad/sec; the amount of mismatch allowed was dependent on the type of high order dynamics added on the match frequency range; pilots did not accept high order appearing dynamics and; time delay is a better correlating parameter than phase lag at the configuration natural frequency. Equivalent systems analysis established criteria for the different flying qualities levels in terms of equivalent parameters. GRA

N80-31415# Johns-Manville Sales Corp., Denver, Colo. Research and Development Center.
HEAT RECLAMATION FROM FLIGHT SIMULATORS: SUMMARY Final Report, 1 Sep. 1978 - Mar. 1980
P. B. Shepherd 13 Jun. 1980 17 p
(AD-A087295; USAFESA-TS-2083) Avail: NTIS HC A02/MF A01 CSCL 13/1

A survey of selected Army flight simulator facilities was performed to determine the applicability of heat recovery devices to the associated air conditioning equipment. It was concluded that there is little potential for heat recovery at nearly all of the facilities because the refrigerant used (R-22) and the operating characteristics of the chillers produce compressor discharge temperatures too low to be suitable for any purposes other than chilled air reheat for humidity control. GRA

N80-31416# Royal Aircraft Establishment, Farnborough (England).
POSSIBLE METHODS FOR REMOVING SMALL AIRBORNE PARTICLES FROM THE FLOW IN THE 5 METER PRESSURIZED LOW-SPEED WIND TUNNEL
P. J. Butterworth London HMSO Dec. 1979 26 p refs
(RAE-TM-Aero-1826; BR73802) Avail: NTIS HC A03/MF A01

Because of the size and complexity of the 5 meter wind tunnel, its use raises problems of erosion of wind-tunnel models which were not encountered with other low-speed facilities. Two methods for removal of small particles were investigated. They are the use of fine mesh fabric screens as filters, and aerodynamic separation at the corners of the tunnel circuit. The results show that particles smaller than 0.3 mm cannot be filtered out within the practicable pressure drop limitations of the tunnel circuit. However, small particles have a sufficiently high probability of striking the concave surfaces of the corner vanes that if grease or some other retentive material were applied, the particles could be quickly removed from the circuit. This latter method is being kept in reserve for the 5 meter tunnel, since physical means such as sweeping and vacuum cleaning seem to give adequate results. After lengthy shutdown for maintenance of an 8 ft x 8 ft tunnel, the lower parts of the corner vanes of that tunnel are coated with a suitable grease to remove small airborne particles. Author (ESA)

N80-31417# Royal Aircraft Establishment, Farnborough (England).
EXPLORATORY STUDIES ON THE DESIGN OF ACOUSTIC SPLITTERS FOR WIND TUNNELS
W. J. G. Trebble London HMSO Jan. 1980 31 p refs
(RAE-TM-Aero-1829; BR72353) Avail: NTIS HC A03/MF A01

The choise of geometry and materials for acoustic splitters in wind tunnels is discussed with particular reference to the requirements for modifying a 5 ft and a 24 ft wind tunnel. The optimum theoretical design of acoustic splitters is considered and practical materials to match the requirements are chosen. Experimental investigations at small scale in an aero-acoustic research rig with ducted flow are described. Attention is drawn to the need for the splitters to have a good aerodynamic profile and to the problems associated with the self-noise of the splitters when they are installed in high-speed section of the tunnel circuit. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-31418*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MATERIALS PROCESSING IN SPACE PROGRAM TASKS Fiscal Year, 1980
R. J. Naumann, ed. Aug. 1980 193 p
(NASA-TM-78294) Avail: NTIS HC A09/MF A01 CSCL 22A

The history, strategy, and overall goal of NASA's Office of Space and Terrestrial Applications program for materials processing in space are described as well as the organizational structures and personnel involved. An overview of each research task is presented and recent publications are listed. A.R.H.

N80-31419*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS PROCESSING IN SPACE, 1980 SCIENCE PLANNING DOCUMENT
Robert J. Naumann Aug. 1980 167 p
(NASA-TM-78297) Avail: NTIS HC A08/MF A01 CSCL 22A

The scientific aspects of the Materials Processing in Space program are described with emphasis on the major categories of interest: (1) crystal growth; (2) solidification of metals, alloys, and composites; (3) fluids and chemical processes; (4) containerless processing, glasses, and refractories; (5) ultrahigh vacuum processes; and (6) bioprocessing. An index is provided for each of these areas. The possible contributions that materials science experiments in space can make to the various disciplines are summarized, and the necessity for performing experiments in space is justified. What has been learned from previous experiments relating to space processing, current investigations, and remaining issues that require resolution are discussed. Recommendations for the future direction of the program are included. A.R.H.

N80-31420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS
Richard Horowitz, ed. and Robert W. Nostreys, ed. Aug. 1980 319 p
(NASA-TM-80905; NSSDC/WDC-A-R/S-80-06) Avail: NTIS HC A14/MF A01 CSCL 22A

Information on current and planned spacecraft activity for a broad range of scientific disciplines is presented. The information covers a wide range of disciplines: astronomy, Earth sciences, meteorology, planetary sciences, aeronomy, particles and fields, solar physics, life sciences, and material sciences. These spacecraft projects represent the efforts and funding of individual countries as well as cooperative arrangements among different countries. R.C.T.

N80-31421*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN PROBLEMS OF SPACE BIOTECHNOLOGY
V. N. Gilyarov Jun. 1980 12 p Transl. into ENGLISH of "Nekotoryye Zadachi Kosmicheskoy Bioteknologii", Rept. Pr-345 Acad. of Sci. USSR, Moscow, 1977 p 1-13 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76235; Pr-345) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments in the field of biotechnology conducted by the USA Apollo and Skylab space probes are described, as well as the joint Soviet-American Apollo-Soyuz Test Project (ASTP). Experiments in electrophoretic separation in space of biological compounds in a liquid medium are detailed. Space processing of vaccines and separation of human and animal cells are described. Methyl-cellulose, a coating for use in electrophoresis was developed. Erythropoietin, which stimulates the formation of red blood corpuscles in bone marrow, was obtained in pure form. S.J.

N80-31422*# KMS Fusion, Inc., Ann Arbor, Mich. Div. of Material Sciences
GLASS SHELL MANUFACTURING IN SPACE Semiannual Report, Dec. 1979 - May 1980
Robert L. Nolen, Jr., Matthias A. Ebner, and Raymond L. Downs 25 Jun. 1980 27 p
(Contract NAS8-33103)
(NASA-CR-161556) Avail: NTIS HC A03/MF A01 CSCL 22A

A heat transfer model was developed that mathematically describes the heating and calculates the thermal history of a gel particle in free-fall through the furnace. The model parameters that greatly affect the calculations were found to be gel particle mass, geometry, specific heat, and furnace gas. Empirical testing of the model has commenced. The code calculations and the initial empirical testing results both indicate that the gel-to-shell transformation occurs early and rapidly in the thermal history of the gel particle, and that for current work the heat transfer rate is not a limitation in shell production. Author

N80-31423*# General Dynamics/Convair, San Diego, Calif.
CONCEPTUAL DESIGN OF AN ORBITAL PROPELLANT TRANSFER EXPERIMENT. VOLUME 2: STUDY RESULTS
G. L. Drake, C. E. Bassett, F. Merino, L. E. Siden, R. E. Bradley, E. J. Carr, and R. E. Parker Aug. 1980 196 p refs
(Contract NAS3-21935)
(NASA-CR-165150; GDC-ASP-80-013-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 22A

The OTV configurations, operations and requirements planned for the period from the 1980's to the 1990's were reviewed and a propellant transfer experiment was designed that would support the needs of these advanced OTV operational concepts. An overall integrated propellant management technology plan for all NASA centers was developed. The preliminary cost estimate (for planning purposes only) is $56.7 M, of which approximately $31.8 M is for shuttle user costs. R.K.G.

N80-31424# Analytical and Computational Mathematics, Zurich (Switzerland).
INTERPLANETARY TWO POINT BOUNDARY VALUE PROBLEMS: EXTENSION OF THE UNIFIED SYSTEM FOR ORBIT COMPUTATION (USOC), VOLUME 4
Dec. 1979 241 p refs
(Contract ESOC-3488/78-D-IM(SC))
(ESA-CR(P)-1347) Avail: NTIS HC A11/MF A01

The unified system for orbit computation was extended to allow the resolution of two point boundary value problems for interplanetary flight computation. The implementation is done in three different stages corresponding to three levels of accuracy: unperturbed patched conics method, method of matched asymptotic expansions, and numerical quasilinearization method. Author (ESA)

N80-31425# European Space Agency, Paris (France).
INVESTIGATIONS INTO THE ELECTRODEPOSITION OF DISPERSION LAYERS UNDER ZERO GRAVITY CONDITIONS
Josef Ehrhardt Nov. 1979 82 p refs Transl. into ENGLISH of "Studie ueber die Galvanische Abscheidung von Dispersionsschichten unter Weltraumbedingungen", Rept. BMFT-FB-W-771 Bundesmin. fuer Forschung und Technol., Dec. 1977 Original report in GERMAN previously announced as N79-30347
(ESA-TT-574; BMFT-FB-W-77-11) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany, DM 21

Spacelab experiments are proposed to investigate the behavior of particles suspended in an electrolyte during migration to the cathode and during their incorporation in the deposition layer. The precise deposition mechanism is unknown and the transport of the dispersoid to the cathode cannot be investigated under terrestrial conditions because of sedimentation and convection. A survey of the literature was made regarding deposition mechanisms, increase of strength, hardness and resistance to oxidation, improvement of the wear resistance, dry lubrication, and improvement of corrosion behavior. Design considerations for an electrolytic cell were defined to the extent that a laboratory version can be constructed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-31426*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE SECULAR DECREASE IN THE SEMIMAJOR AXIS OF LAGEOS ORBIT
David Parry Rubincam Jul. 1980 43 p refs Submitted for publication
(NASA-TM-80734) Avail: NTIS HC A03/MF A01 CSCL 22A

The semimajor axis of the Lageos orbit is decreasing secularly at the rate of -1.1 mm/day due to an unknown force. Nine possible mechanisms are investigated. Five of the mechanisms, resonance with the Earth's gravitational field, gravitational radiation, the Poynting-Robertson effect, transfer of spin angular momentum to the orbital angular momentum, and drag from near Earth dust are ruled out because they are too small to require unacceptable assumptions to account for the observed rate. Three other mechanisms, the Yarkovsky effect, the Schach effect, and terrestrial radiation pressure could possibly give the proper order of magnitude for the decay rate, but the characteristic signatures of these perturbations do not agree with the observed secular decrease. Atmospheric drag from a combination of charged and neutral particles is the most likely cause for the orbital decay. This mechanism explains at least 71 percent of the observed rate of decrease of the semimajor axis. Author

N80-31427# Royal Aircraft Establishment, Farnborough (England).
SAMOS 2 (1961 ALPHA 1): ORBIT DETERMINATION AND ANALYSIS AT 31:2 RESPONSE
Doreen M. C. Walker London HMSO Feb. 1980 31 p refs (RAE-TR-80022; RAE-Space-575; BR73770) Avail: NTIS HC A03/MF A01

Samos 2, 1961 alpha 1, launched on 31 January 1961, was the first satellite to enter a Sun-synchronous orbit at an inclination of 97.4 deg. The initial perigee and apogee heights were 474 km and 557 km respectively, the initial period was 94.97 min and the satellite decayed 21 October 1973 after more than 12 years in orbit. Samos 2 passed through the condition of 31:2 resonance in June 1971 and orbital parameters were determined at 22 epochs from 1974 observations using the RAE orbit refinement program, PROP, between mid April and mid September 1971. The variations of inclination and eccentricity during this time were analyzed and values for six lumped 31st order harmonic coefficients in the geopotential were obtained. These lumped harmonic coefficients were compared with those derived from the individual coefficients of order 31 and appropriate degrees, from the most recent Goddard Earth Model, GEM 10C. The decrease in inclination between launch and 1971 was examined. It is found to be caused mainly by a near resonant solar gravitational perturbation. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-31428*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
DESIGN STUDY FOR ELECTRONIC SYSTEM FOR JUPITER ORBIT PROBE (JOP) Final Report, 14 Feb. - 30 Sep. 1978
B. P. Elero, Jr. and G. R. Carignan 30 Sep. 1978 115 p (Contract NAS5-24454)
(NASA-CR-160021; Rept-016117-1-F) Avail: NTIS HC A06/MF A01 CSCL 22B

The conceptial design of the Jupiter probe spectrometer is presented. Block and circuit diagrams are presented along with tabulated aprts lists. Problem areas are considered to be (1) the schedule, (2) weight limitations for the electronic systems, and (3) radiation hardness of the electronic devices. F.O.S.

N80-31429# National Environmental Satellite Service, Washington, D. C.
SATELLITE ACTIVITIES OF NOAA, 1979
Jul. 1980 25 p
Avail: NTIS HC A02/MF A01

Programs using satellite data from the National Oceanic and Atmospheric Administration's polar orbiting and geostationary systems are described. These include: determining winds and temperature; monitoring global radiation; environmental warning systems; monitoring agriculture conditions; determining Earth's shape and gravity field; fisheries monitoring; and determining oceans, lakes, and hydrological conditions. L.F.M.

N80-31430# Defense Communications Agency, Arlington, Va. MILSATCOM Systems Office.
LEASE VERSUS BUY CONSIDERATIONS FOR MILSATCOM SYSTEMS AND AN ACQUISITION STRATEGY FOR STRATSAT SSS LEASE/BUY STUDY Final Report
Leonard G. Larson and Ralph L. Spaulding Apr. 1980 99 p
(AD-A087411; AD-E100349; DCA/MSO-TR-80-1) Avail: NTIS HC A05/MF A01 CSCL 15/5

This report examines the lease/buy question as it applies to MILSATCOM systems to illuminate the issues involved and identify the factors that tend to drive a decision toward one or the other acquisition method. The report is organized into five sections: (1) lease vs. buy considerations for MILSATCOM systems - a tutorial on the various aspects pertaining to lease vs. buy consideration; (2) acquisition strategy for STRATSAT - discussion of four possible acquisition strategies to acquire STRATSAT; (3) comparative cost analysis of STRATSAT lease vs. buy options - discussion of methodology and results of the lease vs. buy cost comparisons; (4) contractor responses to leasing STRATSAT - review of contractor positions and views related to the practicality and feasibility of leasing STRATSAT; and (5) appendixes - description of leasing arrangements for GAPFILLER, LEASAT, and TDRSS. GRA

N80-31431# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
TEST OF AN ELECTROHYDRAULIC DIGITAL ACTUATOR FOR ADVANCED MISSILE SYSTEMS Final Report, Sep. 1978 - Sep. 1979
Mark C. Twyman Feb. 1980 75 p refs
(AD-A087274; AFWAL-TR-80-2001) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report describes the testing of a digital electrohydraulic stepper actuator developed by Bendix Systems Division under a previous Air Force R & D contract. The testing included calibration and 50 hours of durability cycling type tests. The actuator was designed for a stall torque of 2000 in. pounds at a 3000 psi differential pressure. A discussion of the problems encountered during this program and an inspection analysis of the actuator after testing are included in this report. GRA

N80-31432# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DSCS 2, BATTERY ANOMALY INVESTIGATION SATELLITES

9437 AND 9438 Final Report
Paul Bauer and Charles Lurie 25 Apr. 1980 324 p refs
(Contract F04701-77-C-0118)
(AD-A087390; TRW-32824-AR-019-01; SD-TR-80-33) Avail: NTIS HC A14/MF A01 CSCL 10/3

This report presents a description of the anomalous behavior of the electric power subsystems of DSCS 2 satellites 9437 and 9438, and of the investigations conducted to determine the cause of the anomalies. These investigations include ground test simulations using flight-configuration batteries, component level testing, and analyses of components and systems. The investigations are described and the results discussed. The study concludes that the anomalous behavior was the result of battery cell short circuiting. The cause of the short circuiting is identified as excessive overcharge, its cause and the corrective actions taken are discussed. GRA

N80-31433# Aerojet Services Co., Sacramento, Calif.
ENGINEERING SERVICES IN SUPPORT OF SOUNDING ROCKETS Final Report, 1 Jul. 1977 - 30 Nov. 1979
James F. Olsen Hanscom AFB, Mass. AFGL Nov. 1979 17 p
(Contract F19628-77-C-0182)
(AD-A087801; ASC-2895FR-01) Avail: NTIS HC A02/MF A01 CSCL 22/2

Engineering field personnel provide support for launch of sixteen sounding rockets from two launch sites. Sixteen engineering tasks were performed. GRA

N80-31434# Honeywell, Inc., Hopkins, Minn.
THE MINI-REFRACTIONSONDE SYSTEM (MRS) FOR MEASURING REFRACTIVE INDEX
Curtis D. Motchenbacheh Jun. 1979 5 p Sponsored by NADC
(AD-A087845; GIDEP-E164-0689) Avail: NTIS HC A02/MF A01 CSCL 20/6

This paper discusses the mini-refractionsonde program plan and status. The development of the sonde, ground station, balloon filling and handling equipment are described. Discussions on utilization of the sonde are included. GRA

N80-31435# Battelle Pacific Northwest Labs., Richland, Wash.
WORKSHOP ON SATELLITE POWER SYSTEMS (SPS) EFFECTS ON OPTICAL AND RADIO ASTRONOMY
G. M. Stokes and P. A. Ekstrom Apr. 1980 273 p refs Conf. held at Seattle, May 1979
(Contract EY-76-C-06-1830)
(CONF-7905143) Avail: NTIS HC A12/MF A01

The impacts of the satellite solar power system on astronomy are concluded to be: increased sky brightness, reducing the effective aperture of terrestrial telescopes; microwave leakage radiation causing erroneous radioastronomical signals; direct overload of radioastronomical receivers at centimeter wavelengths; and unintentional radio emissions associated with massive amounts of microwave power or with the presence of large, warm structures in orbit causing the satellites to appear as individual stationary radio sources; finally, the fixed location of the geostationary satellite orbits would result in fixed regions of the sky being unusable for observations. DOE

N80-31436# Royal Aircraft Establishment, Farnborough (England).
THE MAGNETIC TESTING OF THE X4 SPACECRAFT
D. W. S. Lodge London HMSO Dec. 1979 28 p refs
(RAE-TR-79144; RAE-Space-572; BR72759) Avail: NTIS HC A03/MF A01

The X4 spacecraft (named Miranda after launch) was tested in a magnetic test facility to confirm that the design aim of a spacecraft permanent and stray magnetic moment of less than 0.63 micro Wb.m was achieved and to establish worst case conditions. These objectives were satisfactorily met for both the integration and flight models. The flight model left the facility with a permanent moment of 0.04 micro Wb.m, negligible stray moment and symmetrical induced moments of approximately 0.2 micro Wb.m in each axis. The integration model was returned after the launch and exhibited no significant change in its magnetic properties. Tests were also carried out on satellite subsystems, in particular the experiment B, C and D package. Author (ESA)

N80-31437# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
PROCESSING OF METEOSAT ATTITUDE MEASUREMENT FLIGHT DATA AND EVALUATION OF THE PERFORMANCE OF AN ADAPTIVE FILTERING TECHNIQUE
C. R. Traas and G. Moek 18 Aug. 1978 69 p refs
(Contract ESTEC-3319/77)
(NLR-TR-78146-U) Avail: NTIS HC A04/MF A01

The attitude measurement data of the geosynchronous spacecraft Meteosat were analyzed using an adaptive recursive filtering technique. The mathematical models of spacecraft dynamics and sensors were kept very simple. Modeling errors are such that without adaptive feedback, strong divergence of the filtering process occurs. It is shown that the adaptive process stabilizes the filtering considerably. Complete error consistently, however, could not be attained in the present case. The background of this latter fact is analyzed. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-31438*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
SPACE SHUTTLE ORBITER FLOW VISUALIZATION STUDY
Dale J. Lorincz Feb. 1980 68 p refs Original contains color illustrations
(Contract NAS4-2616)
(NASA-CR-163092; NOR-80-82) Avail: NTIS HC A04/MF A01 CSCL 22B

The vortex flows generated at subsonic speed during the final portion of atmospheric reentry were defined using a 0.01 scale model of the orbiter in a diagnostic water tunnel. Flow visualization photographs were obtained over an angle-of-attack range to 40 deg and sideslip angles up to 10 deg. The vortex flow field development, vortex path, and vortex breakdown characteristics were determined as a function of angle-of-attack at zero sideslip. Vortex flows were found to develop on the highly swept glove, on the wing, and on the upper surface of the fuselage. No significant asymmetries were observed at zero sideslip in the water tunnel tests. The sensitivity of the upper surface vortex flow fields to variations in sideslip angle was also studied. The vortex formed on the glove remained very stable in position above the wing up through the 10 deg of sideslip tested. There was a change in the vortex lifts under sideslip due to effective change in leading-edge sweep angles. Asymmetric flow separation occurred on the upper surface of the fuselage at small sideslip angles. The influence of vortex flow fields in sideslip on the lateral/ directional characteristics of the orbiter is discussed. A.R.H.

N80-31439*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TACAN OPERATIONAL DESCRIPTION FOR THE SPACE SHUTTLE ORBITAL FLIGHT TEST PROGRAM
C. L. Hughes and Paul J. Hudock Nov. 1979 90 p refs
(Contract NAS9-15800)
(NASA-CR-160775; LEC-13790; JSC-16276) Avail: NTIS HC A05/MF A01 CSCL 17G

The TACAN subsystems (three TACAN transponders, six antennas, a subsystem operating program, and redundancy management software in a tutorial form) are discussed and the interaction between these subsystems and the shuttle navigation system are identified. The use of TACAN during the first space transportation system (STS-1), is followed by a brief functional description of the TACAN hardware, then proceeds to cover the software units with a view to the STS-1, and ends with a discussion on the shuttle usage of the TACAN data and anticipated performance. R.K.G.

N80-31440*# Analytic Sciences Corp., Reading, Mass.
SPACE SHUTTLE NAVIGATION ANALYSIS. VOLUME 1:

GPS AIDED NAVIGATION Final Report
G. A. Matchett, M. A. Vogel, and T. J. MacDonald 31 May 1980 245 p refs
(Contract NAS9-15151)
(NASA-CR-160765; TR-1001-1-1-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 22A

Analytical studies related to space shuttle navigation are presented. Studies related to the addition of NAVSTAR Global Positioning System user equipment to the shuttle avionics suite are presented. The GPS studies center about navigation accuracy (covariance analyses for both developmental and operational phases of GPS, as well as for various orbiter mission phases. T.M.

N80-31441*# Analytic Sciences Corp., Reading, Mass.
SPACE SHUTTLE NAVIGATION ANALYSIS. VOLUME 2: BASELINE SYSTEM NAVIGATION Final Report
Harold L. Jones, Gerd Luders, Gary A. Matchett, and Robert G. Rains 30 May 1980 99 p refs
(Contract NAS9-15151)
(NASA-CR-160766; TR-1001-1-1-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 22A

Studies related to the baseline navigation system for the orbiter are presented. The baseline navigation system studies include a covariance analysis of the Inertial Measurement Unit calibration and alignment procedures, postflight IMU error recovery for the approach and landing phases, on-orbit calibration of IMU instrument biases, and a covariance analysis of entry and prelaunch navigation system performance. T.M.

N80-31442*# Fairchild Stratos Corp., Manhattan Beach, Calif.
SPACE TRANSPORTATION SYSTEM DISCONNECT Final Report
5 Mar. 1980 145 p
(Contract NAS8-32806)
(NASA-CR-161565; ER-76300-5) Avail: NTIS HC A07/MF A01 CSCL 22B

The use of medium duty 300 psi fluid disconnects for orbital servicing was demonstrated to be both practical and technically feasible. A prototype disconnect was designed and tested, based on criteria formulated from a survey of expected usage requirements for orbital servicing concepts. Testing involved the comparison of three seal materials (EPR, Neoprene and Teflon), and two test media (helium and Freon 21), and was conducted over a temperature range of -150 F to +225 F. Results indicate low helium leakage (10 to the -4 power sccs) and extremely low engagement forces (56 lb sub f). Testing was also performed on a new seal design. Design concepts for a cryogenic disconnect and a high pressure disconnect were investigated. Results of an industry survey for usable orbital servicing disconnects and areas needing attention in future studies are discussed. A.R.H.

N80-31443*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PREVENTION OF ELECTRICAL BREAKDOWN AND ELECTROSTATIC VOLTAGE PROBLEMS IN THE SPACE SHUTTLE AND ITS PAYLOADS. PART 1: THEORY AND PHENOMENA Final Report
Dennis W. Whitson 3 Feb. 1975 110 p refs
(NASA-TM-81137; JSC-09331-1-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 22B

An introduction to the theory of corona discharge and electrostatic phenomena is presented. The theory is mainly qualitative so that workers in the field should not have to go outisde this manual for an understanding of the relevant phenomena. Some of the problems that may occur with the space shuttle in regard to electrical discharge are discussed. E.D.K.

N80-31444*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PREVENTION OF ELECTRONICAL BREAKDOWN AND ELECTROSTATIC VOLTAGE PROBLEMS IN THE SPACE SHUTTLE AND ITS PAYLOADS. PART 2: DESIGN GUIDES AND OPERATIONS CONSIDERATIONS
Dennis W. Whitson 3 Feb. 1975 48 p refs
(NASA-TM-81138; JSC-09331-2-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 22B

The specific electrical discharge problems that can directly affect the shuttle vehicle and its payloads are addressed. General design guidelines are provided to assist flight hardware managers in minimizing these kinds of problems. Specific data are included on workmanship practices and system testing while in low pressure environments. Certain electrical discharge problems that may be unique to the design of the shuttle vehicle itself and to its various mission operational models are discussed. E.D.K.

N80-31445*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 4: ONORBIT PROFILE-CYCLE 3.1.1
Jul. 1980 41 p refs Supersedes JSC-14483; Rept-78-FM-51-Rev-1
(NASA-TM-82183; JSC-16683-Vol-4; Rept-80-FM-40-Vol-4; JSC-14483; Rept-78-FM-51-Rev-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The orbital flight test (OFT) phase of the shuttle program consists of four orbital flights beginning in November 1980 and continuing through 1981. The major purpose of the OFT program is to demonstrate and verify shuttle systems and flight capabilities by satisfying the OFT requirements, is presented. The onorbit portion of the operational flight profile (OFP) for the first Space Transportation System-1 (STS-1) flight is presented. This onorbit document (volume 4) is one in a series that, taken together, will define the STS-1 OFP. This OFP onorbit document represents a combination of the STS-1 ground rules and constraints and the initialization data. The STS-1 flight activities described reflect the trajectory, consumable, crew activity, and flight requirement baseline as of May 1, 1980. Flight plans for the ascent, onorbit, and descent phases of the test flight are presented. F.O.S.

N80-31446*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
LEVEL B/C SOFTWARE GROUND NAVIGATION PROGRAM. DELTA-T PROCESSOR
Aug. 1980 45 p refs Supersedes Rept-79-FM-1
(NASA-TM-82184; JSC-16728; Rept-80-FM-34; Rept-79-FM-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The Delta-T Processor (DTP) computes the instantaneous downtrack error in a specified orbiter onboard navigation state vector recovered via downlink telemetry. The downtrack error, expressed in units of time, is computed based on current incoming Earth based range and Doppler navigation tracking data and the ground selected onboard navigation state vector. The computed time difference when used to modify the timetag of the vector used for onboard navigation reduces the instantaneous downtrack error in this vector to within the threshold of the DTP, the input data, and the onboard software. This threshold is currently estimated to be approximately 2 to 4 nautical miles. The DTP is not restricted to using only onboard vectors. Any vector, either input via the manual entry device or accessible via the vector administration table, may be used. The DTP does not require that both data types be available. E.D.K.

N80-31314*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE STATUS
Donald K. Slayton *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 94-116
(For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-31447*# Boeing Aerospace Co., Seattle, Wash. Engineering Technology.

DESIGN, FABRICATION AND TEST OF GRAPHITE/POLYIMIDE COMPOSITE JOINTS AND ATTACHMENTS FOR ADVANCED AEROSPACE VEHICLES Quarterly Technical Progress Report, 1 Oct. 1979 - 31 Jan. 1980

D. E. Skoumal 15 Feb. 1980 62 p refs

(Contract NAS1-15644)

(NASA-CR-159111; QTPR-4) Avail: NTIS HC A04/MF A01 CSCL 22B

Bonded and bolted designs are presented for each of four major attachment types. Prepreg processing problems are discussed and quality control data are given for lots 2W4604, 2W4632 and 2W4643. Preliminary design allowables test results for tension tests and compression tests of laminates are included. The final small specimen test matrix is defined and the configuration of symmetric step-lap joint specimens are shown. Finite element modeling studies of a double lap joint were performed to evaluate the number of elements required through the adhesive thickness to assess effects of various joint parameters on stress distributions. Results of finite element analyses assessing the effect of an adhesive fillet on the stress distribution in a double lap joint are examined. A.R.H.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-31448# Northeastern Univ., Boston, Mass. Electronics Research Lab.

COMMUNICATION AND INSTRUMENTATION SYSTEMS FOR SPACE VEHICLES Final Report, 12 Jan. 1976 - 30 Nov. 1979

J. Spencer Rochefort, Lawrence J. OConnor, and Norman C. Poirier 1 Jan. 1980 63 p refs

(Contract F19628-76-C-0111; AF Proj. 7659)

(AD-A087944; AFGL-TR-80-0189) Avail: NTIS HC A04/MF A01 CSCL 22/2

Contract effort can be grouped under airborne and ground support instrumentation systems, rocket and balloon field programs, and evaluation testing of commercial telemetry components. Instrumentation systems developed have included pre-flight calibrators, ground-based radiometers, airborne photometers, airborne television, a PCM encoder and a commutated-umbilical ground check-out system. Rocket field programs have been involved with HIRIS, multi-E-fields, LN2 interferometers, composition technology, payload dynamics, field widened interferometers, the ECLIPSE '79 program, a post burn-out thrust experiment and an echelle spectrometer. Balloon field programs have been concerned with an airborne photometer, the BAMM program and an extreme ultraviolet experiment. Brief mention is given to the components tested under an evaluation program concerned with such airborne components as, voltage controlled oscillators, VHF and UHF transmitters and lithium batteries.GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-31449*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LARGE SPACE SYSTEMS/LOW-THRUST PROPULSION TECHNOLOGY

Jul. 1980 347 p refs Meeting held at Cleveland, 20-21 May 1980

(NASA-CP-2144; E-510) Avail: NTIS HC A15/MF A01 CSCL 21H

The potentially critical interactions that occur between propulsion, structures and materials, and controls for large spacecraft are considered, the technology impacts within these fields are defined and the net effect on large systems and the resulting missions is determined. Topical areas are systems/mission analysis, LSS static and dynamic characterization, and propulsion systems characterization. For individual titles, see N80-31450 through N80-31471.

N80-31450*# National Aeronautics and Space Administration, Washington, D. C.

INTRODUCTION: THE CHALLENGE OF OPTIMUM INTEGRATION OF PROPULSION SYSTEMS AND LARGE SPACE STRUCTURES

Richard F. Carlisle *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 1-8 (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21H

A functional matrix of possible propulsion system characteristics for a spacecraft for deployable and assembled spacecraft structures shows that either electric propulsion or low thrust chemical propulsion systems could provide the propulsion required. The trade-off considerations of a single propulsion engine or multiengines are outlined and it is shown that a single point engine is bounded by some upper limit of thrust for assembled spacecraft. The matrix also shows several additional functions that can be provided to the spacecraft if a propulsion system is an integral part of the spacecraft. A review of all of the functions that can be provided for a spacecraft by an integral propulsion system may result in the inclusion of the propulsion for several functions even if no single function were mandatory. Propulsion interface issues for each combination of engines are identified. A.R.H.

N80-31451*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LARGE SPACE SYSTEMS TECHNOLOGY PROGRAM

Robert L. James, Jr. *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 9-22 (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21H

Technical challenges of shuttle-era large space systems include the development of space-configured spacecraft concepts, compatibility with the space transportation system, and cost effectiveness. The objectives and organization of NASA's large space structures program are outlined and program elements are discussed. The technology for the offset wrap-rip and the maypole (hoop/column) antenna concepts are discussed as well

as analysis techniques for predicting the electromagnetic performance of a broad class of large reflectors. Deployable systems, assembly methods, and modular control systems for space platforms are described. Assembly equipment and devices, surface sensors and shape control, control and stabilization, and integrated analysis and design are also considered. A.R.H.

N80-31452*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC PROPULSION TECHNOLOGY
Robert C. Finke *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 23-30 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

The advanced electric propulsion program is directed towards lowering the specific impulse and increasing the thrust per unit of ion thruster systems. In addition, electrothermal and electromagnetic propulsion technologies are being developed to attempt to fill the gap between the conventional ion thruster and chemical rocket systems. Most of these new concepts are exogenous and are represented by rail accelerators, ablative Teflon thrusters, MPD arcs, Free Radicals, etc. Endogenous systems such as metallic hydrogen offer great promise and are also being pursued. A.R.H.

N80-31453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL PROPULSION TECHNOLOGY
Richard J. Priem *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 31-36 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

An overview of NASA's low thrust liquid chemical propulsion program is presented with particular emphasis on thrust system technology in the ten to one thousand pound thrust range. Key technology issues include high performance of cooled low thrust engines; small cryogenic pumps; multiple starts-shutdowns (10) with slow ramps (approximately 10 seconds); thrust variation - 4/1 in flight and 20/1 between flights; long life (100 hours); improved system weight and size; and propellant selection. A.R.H.

N80-31454*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LSS/PROPULSION INTERACTIONS STUDIES
Omer F. Spurlock *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 37-52 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Interactions between the LSS and the propulsion system are large, significant, interrelated, and complex. Issues and problems in interfacing include the effects on the structure from static, dynamic, and launch loads, control, thrust distribution, throttling, and the environment. Control interaction, the disposal of debris/obsolete spacecraft, and the constraints of launch to low Earth orbit must also be considered. A.R.H.

N80-31455*# Martin Marietta Corp., Bethesda, Md.
DOD LOW-THRUST MISSION STUDIES
William E. Pipes *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 53-71 (For primary document see N80-31449 22-20)
(Contract F04611-79-C-0032)
Avail: NTIS HC A15/MF A01 CSCL 21H

The space transportation system (STS) will be the principal means of launching USAF spacecraft beginning in the 1980's. Since it is manned and reusable it provides new opportunities for unique approaches for cost effective utilization of its capabilities. The STS also places additional requirements and constraints on advanced spacecraft deployment systems that did not previously exist for expandable launch vehicles. To fully utilize these new capabilities designers must be prepared by having cost effective technologies available. Advanced propulsion technology that would provide flexibility, performance, and economic benefits to future Air Force missions was identified. Both electric and chemical propulsion systems are discussed. An LO2/LH2 stage with a torus LO2 tank and 500 lbf pump fed engine is high on the list of propulsion technology. A.R.H.

N80-31456*# General Dynamics Corp., San Diego, Calif.
LOW-THRUST VEHICLES CONCEPT STUDIES
William J. Ketchum *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 73-96 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Low thrust chemical (hydrogen-oxygen) propulsion systems configured specifically for low acceleration orbit transfer of large space systems were studied in order to provide the required additional data to better compare new, low thrust chemical propulsion systems with other propulsion approaches such as advanced electric systems. Study results indicate that it is cost-effective and least risk to combine the low thrust OTV and stowed spacecraft in a single 65 K shuttle. Mission analysis indicates that there are 25 such missions, starting in 1987. Multiple shuttles (LSS in one, OTV in another) result in a 20% increase in LSS (SBR) diameter over single shuttle launches. Synthesis and optimization of the LSS characteristics and OTV capability resulted in determination of the optimum thrust-to-weight and thrust level. For the space based radar with radial truss arms (center thrust application), the optimum thrust-to-weight (maximum) is 0.1, giving a thrust of 2000 lb. For the annular truss (edge-on thrust application) the structure is not as sensitive, and thrust of 1000 lb appears optimum. For the geoplatform, optimum T/W is .15 (3000 lb thrust). The effects of LSS structure material, weight distribution, and unit area density were evaluated, as were the OTV engine thrust transient and number of burns. A.R.H.

N80-31457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-THRUST VEHICLE CONCEPT STUDIES
George R. Smolak *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 97-106 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Part of NASA's orbit transfer vehicle propulsion program is devoted to the development of analytical tools to define propulsion system performance, weight, size, and other parameters, and to develop packing concepts for LSS mission propulsion and payload systems. Packing studies discussed relate to shuttle cargo bay constraints; low thrust engine profile and performance; large space frame concept and weight; low thrust vehicles stowed in shuttle, LSS payload capability, and weight distribution. Further study is needed to determine interactions among propulsion system, payload structures, and shuttle. Low thrust-to-weight ratios are desirable to maximize payload weights and deployed areas. A.R.H.

N80-31458*# Martin Marietta Corp., Bethesda, Md.
PRIMARY PROPULSION/LARGE SPACE SYSTEM INTERACTIONS Progress Report, 20 Sep. 1979 - 20 Sep. 1980
Ralph H. Dergance *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 107-128 (For primary document see N80-31449 22-20)
(Contract NAS3-21955)
Avail: NTIS HC A15/MF A01 CSCL 21H

Three generic types of structural concepts and nonstructural surface densities were selected and combined to represent potential LSS applications. The design characteristics of various classes of large space systems that are impacted by primary propulsion thrust required to effect orbit transfer were identified. The effects of propulsion system thrust-to-mass ratio, thrust transients, and performance on the mass, area, and orbit transfer characteristics of large space systems were determined. A.R.H.

N80-31459*# Boeing Aerospace Co., Seattle, Wash.
AUXILIARY CONTROL OF LSS Progress Report, 28 Aug. 1979 - 27 Nov. 1980
William Smith *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 129-141 (For primary document see N80-31449 22-20)
(Contract NAS3-21952)
Avail: NTIS HC A15/MF A01 CSCL 21H

Seven classes of large space structures were identified and idealized into simple geometric shapes which could be easily modelled. Scaling laws were generated which allowed the seven

ideal structures to be continuously scaled as to size and mass properties over their respective size ranges. Relevant sources of disturbances were determined and their effects on LSS were compared. These disturbances were applied over the range of scaling parameters to generate control force and torque requirements. Important auxiliary propulsion system (APS) characteristics were identified and an APS characteristic sensitivity matrix was established. A.R.H.

N80-31460*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECT OF ORBITAL TRANSFER LOADS ON LARGE PLATFORMS

Joseph E. Walz, Harold G. Bush, Walter L. Heard, Jr., and John J. Rehder *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 143-155 refs (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21H

A preliminary automated structural sizing procedure suitable for conceptual design and early tradeoff studies of large truss platforms configured for shuttle transportation to LEO is discussed as well as some orbital transfer design considerations. Platforms that are sized to withstand orbital transfer loads for the LEO to GEO maneuver are compared to platforms sized only for LEO application. It is concluded that for platforms supporting low mass distributed payloads, platform and strut frequency requirements are strong design drivers for LEO applications. The struts are found to be extremely slender, thinswalled, and of small diameter. If full advantage is to be taken of these minimum mass designs, a manufacturing capability must be developed for long straight struts. For platforms that are to be transferred from LEO to GEO in a deployed state, the orbital transfer loads become design drivers. However, even for an initial thrust-to-weight ratio equal to 0.1, a platform on the order of 100 m diameter appears packageable with its OTV in one shuttle flight, and larger platforms appear possible at lower thrust-to-weight ratios. A.R.H.

N80-31461*# Astro Research Corp., Santa Barbara, Calif.

INFLUENCE OF INTERORBIT ACCELERATION ON THE DESIGN OF LARGE SPACE ANTENNAS

John M. Hedgepeth *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 157-178 refs (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21H

The characteristics of the acceleration-induced loading in structures consisting of triangular lattices are investigated and some initial quantitative results on the effect on the design mass and stowage volume are presented. The approach used defines the structural design that would be used if no interorbit acceleration were required and then determines what strengthening would be required to accommodate the loads due to acceleration. The basic zero acceleration design can be based on the stringent accuracy requirements placed on the antennas. A.R.H.

N80-31462*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTEGRATED ANALYSIS OF LARGE SPACE SYSTEMS c66

Joseph P. Young *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 179-192 (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 12B

Based on the belief that actual flight hardware development of large space systems will necessitate a formalized method of integrating the various engineering discipline analyses, an efficient highly user oriented software system capable of performing interdisciplinary design analyses with tolerable solution turnaround time is planned Specific analysis capability goals were set forth with initial emphasis given to sequential and quasi-static thermal/structural analysis and fully coupled structural/control system analysis. Subsequently, the IAC would be expanded to include a fully coupled thermal/structural/control system, electromagnetic radiation, and optical performance analyses. A.R.H.

N80-31463*# Boeing Aerospace Co., Seattle, Wash.

INTEGRATED ANALYSIS CAPABILITY FOR LARGE SPACE SYSTEMS c66

Robert G. Vos *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 193-202 (For primary document see N80-31449 22-20)

(Contract NAS5-25767)

Avail: NTIS HC A15/MF A01 CSCL 12B

The development of an integrated analysis computer program capable of performing the conceptual/preliminary structural system design analysis of large space systems is addressed. The integrated analysis capability (IAC) specifications include thermal/structural/controls integration, an emphasis on existing software and interactive graphics and I/O, a project size capability of 1 to 50 users (1 to 5 users concurrent), and the use of the FORTRAN '77 language. The advantages of the DISCOS and NASTRAN computer programs to the IAC are outlined and recommendations for other programs are made. Barriers to the development of the system arising from the interdisciplinary data flow are defined. M.G.

N80-31464*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CONTROLS FOR LSS c66

Fernando Tolivar *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 203-217 (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21H

An overview of control development for large space structures (LSS) is presented addressing the activities of LSS modeling for control synthesis, technology identification and development, and performance evaluation. Specifically discussed are a 100 meter wrap rib antenna, a multiple payload science application platform, and a solar power satellite. In addition, the static shape control of flexible space structures by utilizing the Green's function is described. M.G.

N80-31465*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTRIC PROPULSION AND POWER

David C. Byers *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 219-228 (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21H

The development of electric propulsion systems is discussed and the benefits of these systems to various space mission requirements are outlined. The characteristics and development status of 8 and 30 cm mercury ion thrusters and solar electric propulsion systems are reported. In addition the advantages of an inert gas thruster for Earth orbital missions are examined and include its capability for operation at higher values of specific impulse, the ease at which it can be integrated with space systems, and it's low pollution potential. M.G.

N80-31466*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ELECTRIC PROPULSION FOR SPS

Earle M. Crum *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 229-236 (For primary document see N80-31449 22-20)

Avail: NTIS HC A15/MF A01 CSCL 21C

The design and characteristics of the solar power satellite electric propulsion system are described. Both the payload powered orbital transfer vehicle and the independent powered transfer vehicle configuations are discussed. Mass estimates for the system, the average cost per system unit, and the cost per flight estimates are also given. M.G.

N80-31467*# Aerojet Liquid Rocket Co., Sacramento, Calif.

LOW-THRUST CHEMICAL ROCKET ENGINE STUDY

Joseph A. Mellish *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 237-261 (For primary document see N80-31449 22-20)

(Contract NAS3-21940)

Avail: NTIS HC A15/MF A01 CSCL 21H

Parametric data and preliminary designs on liquid rocket engines for low thrust cargo orbit-transfer-vehicles are described and those items where technology is required to enhance the

designs are identified. The results of film cooling studies to establish the upper chamber pressure limit are given. The study showed that regen cooling with RP-1 was not feasible over the entire thrust and chamber pressure ranges. The thermal data showed that the RP-1 bulk temperature exceeded the study coking temperature limit of 1010 R. Based upon the results presented, O2/H2 and O2/CH4 regen engine systems and O2/H2 film cooled engines were selected for further study in the system analysis. Six engine design concepts are examined. M.G.

N80-31468*# Rockwell International Corp., Pittsburgh, Pa.
LOW-THRUST CHEMICAL PROPULSION
James M. Shoji *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 263-286 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Results from investigations leading to the definition of low thrust chemical engine concepts are described. From the thrust chamber cooling analyses, regenerative/radiation-cooled LO2/H2 thrust chambers offered the largest thrust and chamber pressure operational envelope primarily due to the superior cooling capability of hydrogen and its low critical pressure. Regenerative/radiation-cooled LO2/CH4 offered the next largest operational envelope. The maximum chamber pressure for film/radiation-cooling was significantly lower than for regenerative/radiation-cooling. As in regeneration-cooling, LO2/H2 thrust chambers achieved the highest maximum chamber pressure. LO2/CH4 film/radiation-cooling was found not feasible and LO2/RP-1 film/radiation-cooling was extremely limited. In the engine cycle/configuration evaluation, the engine cycle matrix was defined through the incorporation of the heat transfer results. Engine cycle limits were established with the fuel-cell power cycle achieving the highest chamber pressure; however, the fuel cell system weights were excessive. The staged combustion cycle achieved the next highest chamber pressure but the preburner operational feasibility was in question. M.G.

N80-31469*# Martin Marietta Corp., Bethesda, Md.
LOW-THRUST CHEMICAL ORBIT TO ORBIT PROPULSION SYSTEM PROPELLANT MANAGEMENT STUDY Progress Report, 14 Sep. 1979 - 14 Nov. 1980
Ralph H. Dergance *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 287-310 refs (For primary document see N80-31449 22-20)
(Contract NAS3-21954)
Avail: NTIS HC A15/MF A01 CSCL 21H

Propellant requirements, tankage configurations, preferred propellant management techniques, propulsion systems weights, and technology deficiencies for low thrust expendable propulsion systems are examined. A computer program was utilized which provided a complete propellant inventory (including boil-off for cryogenic cases), pressurant and propellant tank dimensions for a given ullage, pressurant requirements, insulation requirements, and miscellaneous masses. The output also includes the masses of all tanks; the mass of the insulation, engines and other components; total wet system and burnout mass; system mass fraction; total impulse and burn time. M.G.

N80-31470*# Rockwell International Corp., Pittsburgh, Pa.
SOLAR ROCKET SYSTEM CONCEPT ANALYSIS Final Report
Jack A. Boddy *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 311-336 (For primary document see N80-31449 22-20)
(Contract F04611-79-C-0007)
Avail: NTIS HC A15/MF A01 CSCL 21H

The use of solar energy to heat propellant for application to Earth orbital/planetary propulsion systems is of interest because of its performance capabilities. The achievable specific impulse values are approximately double those delivered by a chemical rocket system, and the thrust is at least an order of magnitude greater than that produced by a mercury bombardment ion propulsion thruster. The primary advantage the solar heater thruster has over a mercury ion bombardment system is that its significantly higher thrust permits a marked reduction in mission trip time. The development of the space transportation system, offers the opportunity to utilize the full performance potential of the solar rocket. The requirements for transfer from low Earth orbit (LEO) to geosynchronous equatorial orbit (GEO) was examined as the return trip, GEO to LEO, both with and without payload. Payload weights considered ranged from 2000 to 100,000 pounds. The performance of the solar rocket was compared with that provided by LO2-LH2, N2O4-MMH, and mercury ion bombardment systems. A.R.H.

N80-31471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED CONCEPTS
Bruce A. Banks *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 337-342 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

The relative strengths of those interactions which enable propulsive forces are listed as well as the specific impulse of various propellants. Graphics show the linear synchronous motor of the mass driver, the principle of the direct current electromagnetic launcher, and the characteristics of the rail gun. A.R.H.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-31472*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPROVED SYNTHESIS OF 2,4,8,10-TETROXASPIRO (5.5) UNDECANE Patent Application
Algirdas C. Poshkus, inventor (to NASA) (National Academy of Sciences - National Research Council, Washington, D.C.) Filed 3 Sep. 1980 10 p Sponsored by NASA
(NASA-Case-ARC-11243-2; US-Patent-Appl-SN-183707) Avail: NTIS HC A02/MF A01 CSCL 07C

Pentaerythritol can be converted to its diformal, 2,4,8,10 -tetroxaspiro (5.5) undecane, by heating it ot a temperature within of about 110 to 150 C for a period of up to 10 minutes, in the presence of a slight excess of paraformaldehyde and of a catalytic quantity of an acid catalyst such as sulfuric acid. The reaction may be carried out in two steps, by forming first the monoformal, then the diformal. In any case, total reaction time is about 10 minutes and yield of diformal are greater than 90 percent. Several advantages of the improved process in terms of shortened reaction times, yields labor and energy requirements, adaptability to continuous operation, and overall simplicity and convenience are discussed. NASA

N80-31473*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHEMICAL RESEARCH PROJECTS OFFICE: AN OVERVIEW AND BIBLIOGRAPHY, 1975-1980
D. A. Kourtides, A. H. Heimbuch, and J. A. Parker Aug. 1980 36 p
(NASA-TM-81227; A-8317) Avail: NTIS HC A03/MF A01 CSCL 07D

The activities of the Chemical Research Projects Office at Ames Research Center, Moffett Field, California are reported. The office conducts basic and applied research in the fields of polymer chemistry, computational chemistry, polymer physics, and physical and organic chemistry. It works to identify the chemical research and technology required for solutions to problems of national urgency, synchronous with the aeronautic and space effort. It conducts interdisciplinary research on chemical problems, mainly in areas of macromolecular science and fire research. The office also acts as liaison with the engineering community and assures that relevant technology is made available to other NASA centers, agencies, and industry. Recent accomplishments are listed in this report. Activities of the three research groups, Polymer Research, Aircraft Operating and Safety, and Engineering Testing, are summarized. A complete bibliography which lists all Chemical Research Projects Office publications, contracts, grants, patents, and presentations from 1975 to 1980 is included. L.F.M.

N80-31474# Rocketdyne, Canoga Park, Calif.
RESEARCH STUDIES IN/NF4(+)/SALTS Final Technical Report, 1 Apr. 1977 - 31 Mar. 1980
K. O. Christe 23 May 1980 124 p refs
(Contract DAAG29-77-C-0007)
(AD-A086981; RI/RD80-157; ARO-14394.10-C) Avail: NTIS HC A06/MF A01 CSCL 07/2

This report describes the results of a 3 year program in basic research studies in NF4(-) chemistry. The mechanism of NF4(-) salt formation and decomposition was determined and the decomposition kinetics of NF4AsF6 and NF4BF4 were measured. The formation of NF3(-) salt intermediates, both in the formation and decomposition of NF4(-) salts, was established, and the NF3(-) radical cation was thoroughly characterized by ESR spectroscopy. Improved synthetic methods were developed for NF4SbF6 and its metathesis to other NF4(-) salts. A new method was developed for the synthesis of NF4(-) salts derived from polymeric Lewis acids which do not form HF soluble cesium salts. The following new NF4(-) salts were synthesized and thoroughly characterized: (NF4) 2MnF6, NF4HF2, NF4UF5O, NF4CLO4 and NF4SO3F. In addition, the novel N2F3SnF5 and N2F3SbF6 salts, which are useful burning rate modifiers in solid propellant NF3-F2 gas generator formulations, were prepared and characterized. Unsuccessful attempts were made to prepare NF4NO3, NF4OF4O, NF4BrF4O, NF4BrO4 and NF4(-) salts of several transition metal fluoride anions. Crystal structure determinations of NF4BF4 and NF4SbF6, and the measurement of thermodynamic data on NF4BF4, NF4PF6, NF4AsF6, and NF4SbF6 are in progress. GRA

N80-31475# National Technical Information Service, Springfield, Va.
BIOCOMPATIBLE MATERIALS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1978 - Jun. 1980
Elizabeth A. Harrison Jun. 1980 70 p Supersedes NTIS/PS-79/0697: NTIS/PS-78/0675
(PB80-811904; NTIS/PS-79/0697; NTIS/PS-78/0675) Avail: NTIS HC $30.00/MF $30.00 CSCL 06L

The cited reports cover studies on the fabrication and preparation of biomaterials and the in vivo and in vitro evaluation of the compatility of the materials to tissues and blood components. Utilization in mechanical organs, prosthetic devices, implants, and surgical materials is discussed. This updated bibliography contains 60 abstracts, 24 of which are new entries to the previous edition. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-31476 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EFFECTS OF MOISTURE, RESIDUAL THERMAL CURING STRESSES AND MECHANICAL LOAD ON THE DAMAGE DEVELOPMENT IN QUASI-ISOTROPIC LAMINATES Ph.D. Thesis
Ronald Dean Kriz 1979 128 p
Avail: Univ. Microfilms Order No. 8020212

The maximum moisture absorbed in [01 + or - 45/90] sub s and [0/90/ + or - 45] sub s laminates fabricated from T300/5208 was demonstrated. Emphasis was placed on using reasonable approximations for wet, dry, and out of plane (v sub 23, G sub 23) elastic properties since these properties are required to predict the damage free stress state at the laminate edge. Classical laminate theory and a finite element model were used to predict stress states prior to the first formation of damage. Crack patterns characteristic of the laminate in a wet or dry condition were also predicted using a shear lag model. Development of edge damage was recorded and observed during the test by transferring an image of the damage from the edge surface on to a thin acetate sheet (replica technique), such that the damage imprinted on the acetate sheet could be immediately viewed on a microfiche card reader. Moisture was shown to significantly alter the interior and edge dry stress states due to swelling and a reduction of elastic properties. Dissert. Abstr.

N80-31477 Delaware Univ., Newark.
MICROMECHANICS OF SHORT-FIBER COMPOSITE Ph.D. Thesis
Seuchi Nomura 1980 178 p
Avail: Univ. Microfilms Order No. 8019944

Various mechanical properties of multiphase short fiber composite materials were studied. Each fiber was modeled as an ellipsoidal inclusion embedded in a homogeneous matrix and was distributed unidirectionally and randomly in a transverse plane. Strain field expressions at each point of the composite were obtained by using the Green's function perturbation method and the self consistent approximation, and by making use of these expressions effective constants of the composite such as elastic moduli, thermal conductivities and thermal expansion coefficients were derived. Viscoelastic behavior and work hardening effects were also studied. Dissert. Abstr.

N80-31478 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INVESTIGATION OF CONSTRAINT EFFECTS ON FLAW GROWTH IN COMPOSITE LAMINATES Ph.D. Thesis
Peter Chun-Ngok Yeung 1979 107 p
Avail: Univ. Microfilms Order No. 8020238

Results are presented for the case of a transverse flaw in an interior ply perpendicular to the loading axis. Two orientations of the flawed ply were examined (0 and 90 degrees), and two distinctly different constraint situations were studied (cross-ply constraint and biaxial constraint). Various nondestructive testing methods were employed to evaluate the material response and to determine the damage and damage growth in the specimens. These techniques include replication, ultrasonic c-scan, ultrasonic attenuation, acoustic emission, x-radiography, thermography and stiffness measurement. In-plane constraint is the principal contributor to notched strength and changes in notched strength under quasi-static loading. Through-the-thickness constraint controls the pattern and spacing of transverse cracks in the off-axis plies to form a characteristic damage state in the laminates. Out-of-plane stresses produced by contraints are influential on the growth of damage along ply interfaces, especially during cyclic loading. Dissert. Abstr.

N80-31479*# Boeing Aerospace Co., Seattle, Wash.
LARC-13 ADHESIVE DEVELOPMENT Final Report, Oct. 1978 - Jun. 1980
S. G. Hill, C. H. Sheppard, and J. C. Johnson Jun. 1980 50 p refs
(Contract NAS1-15562)
(NASA-CR-159317; Rept-2-3621) Avail: NTIS HC A03/MF A01 CSCL 11A

A LARC-13 type adhesive system was developed and property data obtained that demonstrated improved thermomechanical properties superior to base LARC-13 adhesive. An improved adhesive for 589 K (600 F) use was developed by physical or chemical modification of LARC-13. The adhesive was optimized for titanium and composite bonding, and a compatible surface preparation for titanium and composite substrates was identified. The data obtained with the improved adhesive system indicated it would meet the 589 K (600 F) properties desired for application on space shuttle components. Average titanium lap shear data were: (1) 21.1 MPa (3355 psi) at RT, (2) 13.0 MPa (1881 psi) at 600 F, and (3) 16.4 MPa (2335) after aging 125 hours at 600 F and tested at 600 F. S.F.

N80-31480*# Celanese Research Co., Summit, N.J.
STUDY OF CATALYST CURED LaRC-160/CELION 6000 COMPOSITES Final Report, Jun. 1979 - Aug. 1980
Robert Edelman Sep. 1980 44 p refs
(Contract NAS1-15749)
(NASA-CR-159335) Avail: NTIS HC A03/MF A01 CSCL 11D

LaRC 160 polyimide was modified with a high temperature peroxide catalyst, USP-138, in an attempt to reduce the final cure temperature to below 316 C. This effort was directed at obtaining a material for 177 C use that would cure at similar temperatures to a high performance epoxy while still maintaining the good moisture resistance of a polymide material. Attempts to prepare a laminate made from Celion 6000 fiber and 5% catalyzed LaRC 160 resin gave a material with minimal properties after curing at 193 C. Acceptable properties were

not obtained until a final cure temperature of 260 C was used. A control laminate containing no catalyst and cured under the same conditions had only half the level of shear strength. The catalyzed LaRC 160 prepreg was also used to examine the possibility of shortening the conventional LaRC 160 cure at 316 C. Maximum properties were obtained using a 2.5% catalyzed product with a final cure temperature of 316 C held for fifteen minutes. Differences in properties between catalyzed and uncatalyzed product disappeared, however, when the cure time at 316 C was extended to 45 minutes. Author

N80-31481*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE VULNERABILITY OF ELECTRIC EQUIPMENT TO CARBON FIBERS OF MIXED LENGTHS: AN ANALYSIS

Wolf Elber Aug. 1980 23 p refs

(NASA-TM-80215) Avail: NTIS HC A02/MF A01 CSCL 11D

The susceptibility of a stereo amplifier to damage from a spectrum of lengths of graphite fibers was calculated. A simple analysis was developed by which such calculations can be based on test results with fibers of uniform lengths. A statistical analysis was applied for the conversation of data for various logical failure criteria. A.R.H.

N80-31482*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A CARBON FIBER EXPOSURE TEST FACILITY AND INSTRUMENTATION

A. L. Newcomb, Jr. Aug. 1980 47 p

(NASA-TM-80220) Avail: NTIS HC A03/MF A01 CSCL 11D

A facility to evaluate the risk associated with the exposure of electrical and electronic equipment to airborne carbon/graphite fibers was constructed. A wide variety of instrumentation is described and illustrated. S.F.

N80-31483# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.

NONLINEAR VISCOELASTIC BEHAVIOR OF A COMPOSITE MATERIAL USING A FINITE ELEMENT MICROMECHANICAL ANALYSIS Interim Report

Brent G. Schaffer and Donald F. Adams Jun. 1980 158 p refs

(Contract DAAG29-79-C-0189)

(AD-A087367; UWME-DR-001-101-1; ARO-16370.1-MS) Avail: NTIS HC A08/MF A01 CSCL 11/4

The analysis uses an elastoplastic finite element micromechanics computer program to model a unidirectional composite subjected to any combination of longitudinal, transverse, and hygrothermal loadings. Time-dependent effects are included by means of nonlinear viscoelastic constitutive equations. The method of solution is based upon the conditions for generalized plane strain which permits a pseudo-three dimensional analysis. It also contains two failure criteria, viz., an octahedral shear stress criterion and a hydrostatic criterion. Application of load or changes in temperature or moisture are input through time-independent increments. A plotting package is also included which allows the user to obtain a total of eight different plots; octahedral shear stress and strain, maximum and minimum principal stress, in-plane shear stress, out-of-plane longitudinal stress, and normal and tangential shear stress on the fiber-matrix interface. The study demonstrates that the associated program is able to model essentially any type of stress input or hygrothermal history. GRA

N80-31484# Dyna East Corp., Wynnewood, Pa.

STATISTICAL ANALYSIS OF STRENGTH AND LIFE OF COMPOSITE MATERIALS Final Report, 1 Apr. 1977 - 31 Oct. 1979

Pei Chi Chou, A. S. D. Wang, Robert Croman, Harry Miller, and James Alper May 1980 72 p refs

(Contract F33615-77-C-5039; AF Proj. 2307; AF Proj. 2419) (AD-A087741; AFWAL-TR-80-4049) Avail: NTIS HC A04/MF A01 CSCL 11/4

Static strength and fatigue life of unidirectional graphite/epoxy composites are studied in terms of statistical models of fatigue degradation and residual strength. A two segment Weibull distribution for fatigue life, and a cumulative damage rule for fatigue are introduced. Experimental tests performed support the assumption that a specimen's rank in strength is equal to its rank in fatigue life. Fatigue weakens the matrix, and thus degrades the residual compression strength, and not the residual tension strength in early life. In some cases, residual tension strength initially increases. Proof tests can guarantee a minimum strength, and to a lesser extent, a minimum fatigue life. GRA

N80-31485# Army Materials and Mechanics Research Center, Watertown, Mass.

THE EFFECT OF MECHANICAL WORKING ON SiC WHISKER-REINFORCED ALUMINUM ALLOYS Final Report

Dennis M. Riggs and Peter Gillis Apr. 1980 18 p

(AD-A087565; AMMRC-TR-80-11) Avail: NTIS HC A02/MF A01 CSCL 11/4

The effects of mechanical working on SiC whisker-reinforced aluminum alloys were investigated. The effects of pressing, extruding, and rolling on whisker dispersion, L/D ratio, and orientation were determined by examination of polished cross sections using conventional optical microscopy and by examination of replicas with a transmission electron microscope. These results were correlated with the mechanical properties of the composite. It was found that mechanical working of the composites significantly degrades the whiskers, particularly the L/D ratio. Extrusion and rolling, however, do impart an orientation to the whiskers in the direction of working. It was also found that clumping observed in the unworked billets is carried through both the extrusion process and rolling. These SiC-rich areas apparently lead to the formation of porosity in the composites during working. The high level of mechanical properties found in the worked composites suggests that optimization of the secondary working parameters (in such a manner as to minimize whisker damage) may result in the realization of a truly unique structural material. GRA

N80-31486# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.

SUPERCONDUCTIVITY IN FILAMENTARY EUTECTIC COMPOSITES Progress Report, 1 Jun. 1979 - 31 May 1980

Mark P. Zaitlin 1980 21 p refs

(Contract DE-AC02-78ER-04938)

(COO-4938-3) Avail: NTIS HC A02/MF A01

Electrical resistivity and magnetic susceptibility were measured as a function of temperature on samples of Nb-Th eutectic composite. Samples with Nb filament radii as small as 38A were used which is considerably less than the coherence length in Nb of approximately 380A. Surprisingly, measurements of all samples show a drop in electrical resistance near the transition temperature of bulk Nb and an unmeasurably small resistance by approximately 8K. The magnetic susceptibility showed essentially perfect diamagnetism below approximately 7K to 9K even for samples with the smallest of filament radii. This is in contradiction to theories of the proximity effect which predict a sharp decrease in the transition temperature for samples with a radius smaller than the coherence length. Some measurements in a static magnetic field were also made. DOE

N80-31487# Cornell Univ., Ithaca, N. Y. School of Mechanical and Aerospace Engineering.

PROBABILISTIC MODELS OF THE STRESS-RUPTURE OF COMPOSITE MATERIAL, PHASE 3 Progress Report, 15 Jun. 1978 - 14 Jun. 1980

S. L. Phoenix Mar. 1980 34 p refs

(Contract EY-76-S-02-4027)

(COO-4027-3) Avail: NTIS HC A03/MF A01

The development of static and time dependent models for the failure of composite materials was pursued. These models are based on the chain of bundles probability model for composite failure wherein local load sharing among nonfailed fiber elements in a bundle plays a key role. At the outset, it was believed that the static model was well developed in the literature by others, and that work on the time dependent versions could proceed. In these versions, the viscoelasticity of the matrix was to be the cause of the time effects. Unfortunately, initial studies showed the published analysis on the static case to be superficial, and a rigorous extension to the time dependent case was not possible.

The static model was thoroughly investigated. Sophisticated analytical and numerical techniques were developed to treat the static model, and these show promise of being extendable to the time dependent case. Exact analysis was performed on composites with few fibers to gain insight, and a recursive technique was developed to treat composites of larger sizes. DOE

N80-31488# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
INELASTIC DEFORMATION IN CRYSTALLINE NONMETALLIC MATERIALS Progress Report
D L. Kohlstedt Apr. 1980 46 p refs
(Contracts DE-AS02-77ER-04441; EG-77-S-02-4441; Grant NSF DMR-76-24180)
(COO-4441-3) Avail: NTIS HC A03/MF A01

Densification of polycrystalline TiC was studied during hot-pressing and sintering of powders. Starting powders of Ti plus C, TiC, and TiC plus Ti were reacted at 1700 C to 1835 C above the melting point of Ti metal (T/sub m/ = 1675 C for Ti). The bulk C:Ti ratio was maintained in the range 0.97 to 0.6 in order to allow the possibility of producing a single phase material. All of the resulting microstructures, examined in the scanning electron microscope, contain press both along the grain boundaries and within the grains. The samples fabricated from Ti metal plus TiC contain substantially fewer pores than those produced from TiC powder alone. Debye-Scherrer X-ray diffraction analyses demonstrate that in the TiC plus Ti runs, all of the Ti is transformed to substoichiometric TiC after a few minutes at 1800 C. While sintering time and temperature have a small influence on the final density, increasing the weight percent of Ti metal added to TiC dramatically increases the final density and the hardness. DOE

N80-31489# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF FIBER-MATRIX INTERFACE STRUCTURE AND INTERFACIAL DIFFUSION PHENOMENA IN COTAC-TYPE SOLIDIFICATION COMPOSITES. EFFECT ON THE THERMAL STABILITY OF THE FIBERS Ph.D. Thesis - Paris-Sud Univ.
Elvire Maroni 1979 102 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-681)
(ONERA-NT-1979-11; ISSN-0078-3781) Avail: NTIS HC A06/MF A01

The fiber matrix interfacial structure of Cotac type composites was determined by electron microscopy. Interfaces were characterized using the diffusion technique. High resolution autoradiographs showed that diffusion was predominant along the fiber matrix interface. The diffusion coefficients of nickel and niobium were measured for Cotac 74 and Ni, Cr-TaC composites in order to obtain the diffusion data required to predict the high temperature stability of Cotac type composites. The high values of the activation energies for the interfacial diffusion of both nickel and niobium result from the interaction of the diffusing species with carbon. The structural stability of Cotac type composites was investigated at elevated temperatures. It is estimated from the experimental data that no degradation due either to isothermal Ostwald ripening or to thermal gradient coarsening should occur in service at high temperatures. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-31490*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYNTHESIS OF DAWSONITES Patent Application
Robert L. Altman, inventor (to NASA) Filed 14 Aug. 1980 10 p
(NASA-Case-ARC-11326 1-1; US-Patent-Appl-SN-178192) Avail: NTIS HC A02/MF A01 CSCL 07A

Alkali metal and ammonium dawsonites are prepared by a nonaqueous process where equimolar quantities of the corresponding hydrogen carbonate and aluminum hydroxide in finely divided state are heated together to a temperature within the range of 150 to 250 C for a period of 1 to 6 hours under a carbon dioxide pressure within the range of 120 to 360 psig. Carbonates may be used instead of hydrogencarbonates. A type of dawsonite is provied that can be used in extinguishing fires caused by hot surface ignition of hydrocarbon fuels. NASA

N80-31491 This accession not used.

N80-31492# Texas Univ. at Austin. Dept. of Chemistry.
PHOTOASSISTED WATER-GAS SHIFT REACTION OVER PLATINIZED Ti O(2) CATALYSTS Technical Report, 1 Jan. - 31 Dec. 1980
Shinri Sato and John M. White 15 Jul. 1980 31 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A087363; TR-15) Avail: NTIS HC A03/MF A01 CSCL 07/4

The reaction of gas phase water with CO (water-gas shift reaction) over platinized, powdered TiO2 is found to be catalytic under UV illumination. The reaction kinetics have been studied at temperatures from 0 to 60 C. At 25 C, the reaction is zero order both in CO and water when p sub CO = or > 0.3 torr and p sub H2O = or > 5 torr and the activation energy is 7.5 kcal/mole. The wavelength dependence of the reaction rate shows a cut-off near, but slightly below, the band gap of titanium oxide. The quantum efficiency of the reaction is about 0.5% at 25 C. GRA

N80-31493# Texas Univ. at Austin. Dept. of Chemistry.
AN ELECTRON SPECTROSCOPIC INVESTIGATION OF THE INTERACTION OF METHANOL WITH POLYCRYSTALLINE ALUMINUM Technical Report, 1 Jan. - 21 Dec. 1980
J. W. Rogers, Jr., R. L. Hance, and J. M. White 15 Jun. 1980 21 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A087309; TR-14) Avail: NTIS HC A02/MF A01 CSCL 07/4

X-ray and ultraviolet photoelectron spectroscopic results are reported for the interaction of CH3OH with clean polycrystalline Al in the temperature range 110-500 K. Methanol is molecularly chemisorbed at low exposure and low temperature (110 K) followed by condensation at higher exposure. The multilayers desorb beginning near 170 K and the chemisorbed layer is converted into a surface methoxide. Room temperature adsorption also leads to formation of the methoxide species which is stable to approximately 500 K, at which point it decomposes evolving CH4 and leaves the surface oxidized. GRA

N80-31494# Texas Univ. at Austin. Dept. of Chemistry.
PHOTOCATALYTIC PRODUCTION OF HYDROGEN FROM WATER AND TEXAS LIGNITE USING A PLATINIZED TITANIA CATALYST Technical Report, 1 Jan. - 31 Dec. 1980

Shimi Sato and John M. White 15 Jul. 1980 11 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A087364; TR-16) Avail: NTIS HC A02/MF A01 CSCL 07/4

Using a physical mixture of powdered Texas lignite and platinized titania in the presence of water vapor and ultraviolet light, we show that a catalytic reaction occurs at 23 C to form hydrogen and carbon dioxide. These results are contrasted with a recent electrochemical conversion process. GRA

N80-31495# Oakland Univ., Rochester, Mich. Dept. of Chemistry.
ELECTROCHEMICAL GENERATION OF THE NAKED METAL ANIONIC CLUSTERS
B. Stanley Pons, David J. Sarture, R. Craig Taylor, and Ralph W. Rudolph (Michigan Univ.) 15 Jun. 1980 8 p refs
(Contract N00014-79-C-0664)
(AD-A087344; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Tin and lead electrodes reduce in the presence of electrodeposited sodium in ethylenediamine to give highly charged naked metal anionic clusters. GRA

N80-31496# Washington Univ., Seattle. Dept. of Chemistry.
COLLISIONAL RELAXATION OF VIBRATIONAL ENERGY TRANSIENT IN THE METHYLCYCLOPROPANE SYSTEM. A VARIABLE ENCOUNTER METHOD STUDY
D. F. Kelley, T. Kasai, and B. S. Rabinovitch 1 Aug. 1980 27 p refs Submitted for publication
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A087802; TR-16) Avail: NTIS HC A03/MF A01 CSCL 07/3

The Variable Encounter Method has been used to study vibrational energy transients in the isomerization of methylcyclopropane to various butenes. This system was studied with reactor surface temperatures of 800 K to 1130 K and average numbers of collisions per encounter with the reactor of 5.6 and 20.0. The reaction rate was treated on the basis of total, rather than individual butene rates, because of butene product interconversion. An exponential model of energy transfer was found to give the best fit to the data with the average down step energy -delta E prime = decreasing from 1860/cm to 1415/cm with increase of temperature over the range studied. Incubation times increased from 14 to 19 collisons with increase in temperture, and these times together with valves of the conventional relative collision efficiency Beta and values of -delta E prime =, are compared with those of other molecules studied by VEM. The calculated transient population distributions and the associated sequential reaction probabilities are also displayed. GRA

N80-31497# United Technologies Research Center, East Hartford, Conn.
CARS CONCENTRATION SENSITIVITY WITH AND WITHOUT NONRESONANT BACKGROUND SUPPRESSION Final Technical Report, 9 May 1979 - 22 Apr. 1980
Alan C. Eckbreth and Robert J. Hall Jun. 1980 71 p refs
(Contract N00014-79-C-0351)
(AD-A087557; UTRC-R80-954628-1) Avail: NTIS HC A04/MF A01 CSCL 07/4

Species detectivity is limited in conventional CARS with aligned laser polarizations by the presence of a background, nonresonant electronic contribution to the CARS signal. At low species densities, a modulated CARS spectrum results which can be used to perform concentration measurements from the spectral shape, a unique feature of CARS. When the species concentration becomes very low, the 'signal' from the specie of interest, i.e., the modulation, essentially disappears into the nonresonant background and the specie is no longer detectable. By proper orientation of the polarizations of the pump and Stokes laser fields and the CARS signal polarization analyzer, the nonresonant background can be suppressed leaving the pure CARS spectrum of the specie being probed. Unfortunately, a factor of sixteen reduction in resonant mode signal accompanies the elimination of the background. In this report, investigations of background suppression from CO in flames are described using polarization sensitive CARS with spectrally broadband Stokes waves. The studies were conducted in flat CO-air diffusion flames employing nonplanar, crossed-beam phase matching, i.e., folded BOXCARS. The relative concentration sensitivity of CARS with and without background suppression was compared at both high and low temperatures. GRA

N80-31498# Duke Univ., Durham, N. C. Dept. of Physics.
MICROWAVE INVESTIGATIONS OF MATTER Final Report, 15 Oct. 1976 - 30 Nov. 1979
Frank C. DeLucia Jun. 1980 91 p refs
(Grant DAAG29-77-G-0007)
(AD-A087480; ARO-14150.7-P) Avail: NTIS HC A05/MF A01 CSCL 07/4

The project 'Microwave Investigations of Matter' represented a broad attack on a wide variety of scientific topics and technological developments in the millimeter and submillimeter spectral region. Attached are the journal publications and a brief summary of our work. In addition to the cited journal publications, approximately an equal number of invited and contributed papers have been presented at scientific meetings. Because the material in these talks is highly correlated with journal articles, they will not be listed separately. GRA

N80-31499# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering.
COMBUSTION STUDIES OF COAL-IN-OIL DROPLETS Final Report, 1 Aug. 1977 - 31 Jul. 1979
C. K. Law Dec. 1979 60 p refs
(Contract DE-FG01-77ET-10660)
(DOE/ET-10660/1) Avail: NTIS HC A04/MF A01

The combustion characteristics of droplets of coal-oil mixtures (COM) were investigated both theoretically and experimentally. The agglomeration of the coal powder occurs upon complete implications regarding radiation transfer, total burning time, and particulate collection efficiency. Agglomeration is somewhat irrelevant for COM with no. 6 oil because of the small volatility differentials between coal and no. 6 oil. As a result of agglomeration, fine-crushing the coal is unnecessary unless they can be reduced to micron-sizes such that agglomerate ignition is facilitated. DOE

N80-31500# Wisconsin Univ. - Madison.
MECHANISTIC STUDIES RELATED TO THE METAL CATALYZED REDUCTION OF CARBON MONOXIDE TO HYDROCARBONS Progress Report, 1 Apr. 1979 - 31 Mar. 1980
Charles P. Casey Apr. 1980 11 p refs
(Contract DE-AC02-77ER-04222)
(DOE/ER-04222/3) Avail: NTIS HC A02/MF A01

The stoichiometric reactions of metal complexes which parallel probable steps in the metal catalyzed reduction of CO are being investigated. The information obtained should be useful in the design and discovery of homogeneous catalysts for the reduction of CO to hydrocarbons. It was found that the structure and kinetic stability of metal formyl compounds are very similar to metal acetyl compounds. However, metal formyl compounds are thermodynamically much less stable than metal acetyl compounds towards decarbonylation. Hydride donation reactions of metal formyl compounds were discovered. A neutral metal formyl compound discovered and its reactions were investigated. Preparation of (C5H5) Re (CO)(NO)(CH2OH), the first authentic example of a hydroxymethyl metal compound, was accomplished and studies of its reactions with acid, with base, with CO, and with H2 were begun. DOE

N80-31501# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
INTERPRETATION OF RAYLEIGH SCATTERING IN A FLAME
I. Namer, R. W. Schefer, and M. Chan Apr. 1980 26 p refs Presented at the Conf. of the Western States Sect. of the Combust. Inst., Irvine, Calif., 21 Apr. 1980
(Contract W-7405-eng-48)
(LBL-10655; CONF-800408-3) Avail: NTIS HC A03/MF A01

Typical values of correction factors as a function of degree of reaction, fuel, and equivalence ratio are calculated for an idealized one dimensional flame front. The fuels considered are

H2, CH4, C2H3, C2H6 and C2H8. Errors of up to 30% can occur in the interpretation of the Rayleigh scattering as gas density for the heavier hydrocarbon fuels due, primarily, to the presence of CO as an intermediate combustion product. Conversely, using H2 as a fuel will result in a maximum error of 3% which is within the expected experimental accuracy of a typical Rayleigh scattering system. The interpretation of Rayleigh scattering as temperature was found to have larger error than the interpretation as density. Nevertheless, when corrections are applied for charges in gas composition, Rayleigh scattering provides an excellent measure of total gas density and temperature in flames. DOE

N80-31502# Brigham Young Univ., Provo, Utah.
INVESTIGATION OF SULFUR-TOLERANT CATALYSTS FOR SELECTIVE SYNTHESIS OF HYDROCARBON LIQUIDS FROM COAL-DERIVED GASES Quarterly Technical Progress Report, 18 Sep. - 18 Dec. 1979
Calvin H. Bartholomew 10 Jan. 1980 24 p refs
(Contract DE-AC01-79ET-14809)
(FE-14809-1) Avail: NTIS HC A02/MF A01

Silica-supported cobalt and iron catalysts were prepared by simple impregnation to incipient wetness with aqueous metal salt solutions. Several impregnations were necessary to ensure a uniform deposition of the metal salt, each followed by intermediate drying. After the final impregnation, the catalysts were dried. These dried samples were then bulk reduced in flowing hydrogen. The reduced catalysts were next passivated with 1% air in nitrogen and crushed to a fine powder for use. The cobalt boride on alumina catalyst was prepared under an N2 blanket in a sealed reaction vessel to avoid the formation of boron oxide. Enough alumina was used so that if all the cobalt adhered to the support 18 wt% metal loading would result. DOE

N80-31503# Wayne State Univ., Detroit, Mich. Coll. of Engineering Energy Center.
ULTRASONIC CHARACTERIZATION OF COAL LIQUEFACTION PRODUCTS Final Report, 11 Apr. 1979 - 11 Feb. 1980
Charles B. Leffert, Leo Weisman, and Diane Moore 29 Feb. 1980 75 p refs
(Contract DE-AC22-79PC-10346)
(DOE/PC-10346/1; CEEC-80-1203-1) Avail: NTIS HC A04/MF A01

The Wayne State University ultrasonic device and technique was used successfully to calibrate coal derived 0 to 45% wt% asphaltene in oil mixtures (2 wt% increments) for transmitted signal strength versus temperature (25 to 100 C). Computer aided cross plots of the transmitted signal strength versus concentration of asphaltene showed that a wide range of concentration and temperature exists where the viscosity dominated (lower temperature) sound absorption is such that a single valued number for the concentration of the asphaltene can be obtained from measurement of the sample temperature and transmitted signal strength and thus obtain a measure of the quality of the coal-derived product. It is concluded that there is an excellent expectation that the Wayne State ultrasonic device and technique could be used to simultaneously measure (on line) the suspended particle concentration as well as the quality of the coal-derived product. DOE

N80-31504# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
CROSSED MOLECULAR BEAM STUDIES OF CHEMILUMINESCENT REACTIONS Ph.D. Thesis
Carol Cuzens Kahler Apr. 1980 175 p refs
(Contract W-7405-eng-48)
(LBL-10545) Avail: NTIS HC A08/MF A01

The chemiluminescent bimolecular halogen-halogen reactions of F2 with I2, Br2, and IC1, were studied by the crossed molecular beam technique. The observed reaction thresholds of 4.2 and 5.9 kcal/mole for I2 + F2, respectively, are the same as the threshold energies for production of the stable trihalogens I2F and C1IF. A threshold of 11.3 kcal/mole was found for Br2 + F2; no threshold for Br2F was previously reported. Also described is a crossed molecular beam study of the chemiluminescent reaction of + O3 yields NO2 + O2. The cross section was found to increase with increasing collision energy. The reaction threshold was 2.1 kcal/mole. The chemiluminescence was found to increase with increasing NO temperature. This is explained by assuming the cross section varies as E sub rot sup 1.4 where E sub rot is the average rotational energy of the NO beam. DOE

N80-31505# Brandeis Univ., Waltham, Mass.
HYDROGEN-TRANSFER AND CHARGE TRANSFER IN PHOTOCHEMICAL AND HIGH ENERGY RADIATION INDUCED REACTIONS: EFFECTS OF THIOLS Final Report, 1 Feb. 1980 - 31 Jan. 1979
Saul G. Cohen Mar. 1980 19 p refs
(Contract EY-76-S-02-3118)
(DOE/ER-03118/13) Avail: NTIS HC A02/MF A01

Absorption of ultraviolet or visible light, or high energy radiation, may lead to highly reactive free radicals. Thiols affect the reactions of these radicals in the following ways: (1) transfer of hydrogen from sulfur of the thiol to a substrate radical, converting the radical to a stable molecule, and the thiol to a reactive thiyl radical; and (2) transfer of hydrogen from a substrate radical or molecule to thiyl, regenerating thiol. The thiol is thus used repeatedly and a single molecule may affect the consequences of many quanta. Three effects may ensue, depending upon the system irridiated: (1) the substrate radicals may be converted by thiol-thiyl to the original molecules, and protection against radiation damage is afforded; (2) the radicals may be converted to molecules not identical with the starting materials, and in both cases damage caused by radical combination processes is prevented; and (3) product yields may be increased where the initial radicals might otherwise regenerate starting materials. DOE

N80-31506# Mound Lab., Miamisburg, Ohio.
AUTOMATED MULTI-SAMPLE GAS CHROMATOGRAPHIC ANALYSIS OF FOSSIL FUEL GASES
Daniel R. Rohler, Gary L. Young, and Victoria M. Franchetti 11 Jun. 1980 21 p ref
(Contract DE-AC04-76DP-00053)
(MLM-2721) Avail: NTIS HC A02/MF A01

Fully automated gas chromatographic analysis of multiple Fischer Assay retort gas samples was achieved. The system used included a commercially available microprocessor controlled gas chromatograph fitted with an inhouse designed and constructed automated gas sampling rack. This system unattended duplicate analysis of four samples and one standard; the total output of analyses per day was twice that using manual operation. Automation of the rack was achieved through microprocessor control of four time programmable contact closures which operate a set of valves and a printer for sampling, regulating, and recording manifold pressure. Accuracies and precisions using the gas chromatograph sampling rack automatically were comparable to those achieved during manual operation. DOE

N80-31507# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF LINEAR ACCELERATOR TECHNOLOGY TO THE DETECTION OF TRACE AMOUNTS OF TRANSURANICS IN WASTE BARRELS
M. R. Cates, B. W. Noel, J. T. Caldwell, W. E. Kunz, D. A. Close, L. A. Franks, and J. L. Pigg 1980 24 p refs Presented at Intern. Symp. on the Management of Alpha-Contaminated Wastes, Vienna, 2-6 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1274; CONF-800611-3) Avail: NTIS HC A02/MF A01

Electron linear accelerators (linacs), as sources of photons and neutrons, can produce a significant number of fissions in transuranic isotopes contained in large barrels of waste material. Both photons and thermal neutrons were used to detect about 1 mg of plutonium in 105 kg matrices. A sequential interrogation with neutrons and photons, easily possible with linacs, can show both fertile and fissile constituents among the heavy mass isotopes. The advantages of linacs in solving existing assay problems include: (1) high available beam current; (2) variable beam current, beam energy, pulse width, and pulse repetition frequency; and (3) beam-scanning ability. They also are compatible with passive assay instruments. Their versatility makes it likely that they will remain useful as assay technology advances. DOE

N80-31508# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
STUDY OF SOLID METAL/CERAMIC REACTIONS Progress Report, 18 Jun. 1979 - 17 Mar. 1980
R. L. Mehan and M. R. Jackson 26 Feb. 1980 40 p refs
(Contract DE-AC02-79ER-10413)
(DOE/ER-10413/1) Avail: NTIS HC A03/MF A01

Ceramic-metal reactions are investigated for SiC, Si/SiC, and Si4N4 with a Ni-Cr-Al superalloy. Results from metallographic and microhardness measurements, reaction kinetics, and investigations of phase relations are presented. Considering the reaction rates of SiC and Si/SiC, the activation energy at lower temperatures (700 C and 800 C) seem similar, with the Si/SiC forming larger reaction zones than SiC. This is consistent with metallographic observations and the fact that more Si is available from Si/SiC than from the decomposition of SiC. However, as the eutectic is approached, the rate increases significantly for the Si/SiC and more so for pure Si. Because of the presence of Cr and Al in the Ni, a liquid phase may form below 900 C. DOE

N80-31509# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
LATTICE EXPANSION AS A MEASURE OF SURFACE SEGREGATION AND SOLUBILITY OF HYDROGEN IN ALPHA-FeTiH/SUB x
J. J. Reilly, J. R. Johnson, F. Reidinger, J. F. Lynch, J. Tanaka, and R. H. Wiswall 1980 19 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo. 7 Apr. 1980
(Contract EY-76-C-02-0016)
(BNL-27523; CONF-800402-12) Avail: NTIS HC A02/MF A01

The lattice expansion of alpha-FeTiH sub x was found to be anomalously small as a function of hydrogen content. The apparent partial molar volume of hydrogen, anti V sub H, was 0.1 + (-0.1) cc/g atom (FeTiH sub < 0.03), a value much lower than the accepted range of 2.2 to 1.4 cc/g atom previously reported the hydrogen metal solutions. The behavior is attributed to preferential occupation by hydrogen of Ti rich sites produced by surface segregation effects which are known to occur in activated FeTi. The alpha/alpha + beta phase boundary is estimated to occur at an overall composition equivalent to FeTi sub approximately 0.04. At this composition approximately 85% of the total hydrogen content is estimated to be associated with surface layers approximately 100 A in depth. Unactivated FeTi (low surface area) behaved quite differently and it is clear that in the low dilution region surface segregation effects play a dominant role with respect to system behavior. DOE

N80-31510# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
THERMOCHEMICAL STABILITY DIAGRAMS FOR CONDENSED PHASES AND VOLATILITY DIAGRAMS FOR VOLATILE SPECIES OVER CONDENSED PHASES IN TWENTY METAL-SULFUR-OXYGEN SYSTEMS BETWEEN 1150 AND 1450 K
E. A. Gulbransen and G. H. Meier May 1980 222 p refs
(Contract DE-AC01-79ET-13547)
(DOE/FE-13547/01) Avail: NTIS HC A10/MF A01

Stability diagrams and diagrams for the volatile metal oxide and sulfide species in the Al-O-S, Ca-O-S, Ce-O-S, Co-O-S, Cr-O-S, Fe-O-S, Hf-O-S, K-O-S, Mg-O-S, Mn-O-S, Mo-O-S, Na-O-S, Ni-O-S, Nb-O-S, Si-O-S, Ta-O-S, Ti-O-S, V-O-S, W-O-S, and Zr-O-S systems are presented. The importance of the volatile species, melting points of the condensed phases and constitution of the condensed phases as a function of the oxygen and sulfur potential of the reaction environment is discussed with regard to high temperature oxidation and hot corrosion of metals and alloys. DOE

N80-31511# Mound Lab., Miamisburg, Ohio.
HYDROGEN MOBILITY AT HIGH CONCENTRATIONS
R. C. Bowman, Jr. 1980 112 p refs
(Contract DE-AC04-76DP-00053)
(MLM-2729(OP)) Avail: NTIS HC A06/MF A01

The roles of crystal structure, hydrogen site occupancy, phase transition, and isotope substitution on the hydrogen diffusion behavior were considered. General diffusion concepts and experimental methods that have been most often used to determine the hydrogen mobility in the high concentration metal hydride phases are presented. Nuclear magnetic resonance techniques that were extensively applied in hydride diffusion studies were reviewed. Plausible models of the microscopic diffusion mechanisms are presented and compared with observed diffusion behavior. DOE

N80-31512# California Univ., Berkeley. Lawrence Berkeley Lab. Physics, Computer Science and Mathematics Div.
NUMERICAL SIMULATION OF THE INTERACTION OF A FLAME WITH A KARMAN VORTEX STREET
I. Karasalo, A. J. Chorin, I. Namer, F. Robben, and L. Talbot Apr. 1980 24 p refs Presented at the Conf. of the Western States Sect. of the Comb. Inst., Irvine, Calif., 21 Apr. 1980
(Contract W-7405-eng-48)
(LBL-10679; CONF-800408-4) Avail: NTIS HC A02/MF A01

A numerical study of a simplified flow configuration modeling the interaction of a laminar flame with a Karman vortex street is presented. The flow is assumed to be inviscid and the flame is modeled as a line source of specific volume with a burning speed which depends on the local curvature. Complete flow fields are calculated as a function of time for various values of the Markstein parameter, vortex shedding frequency, separation and strength. rho sub u/rho sub b was 4.0 and the velocity far upstream was set at 60 cm/s for all cases. The essential features of the interaction of a flame with a vortex street are demonstrated, including a deflection of the vortex street ahead of the flame, a development of a flame brush, the deflection of the mean flame position, and the increase in the mean rate of consumption when the vortices are introduced. DOE

N80-31513# California Univ., Berkeley. Lawrence Berkeley Lab.
CATALYZED COMBUSTION OF LEAN FUEL/AIR MIXTURES
R. W. Schefer and F. Robben Apr. 1980 20 p refs Presented at 4th Workshop on Catalytic Combust., Cincinnati, 14-15 May 1980
(Contract W-7405-eng-48)
(LBL-10842; CONF-800553-1) Avail: NTIS HC A02/MF A01

The effect of catalytic surface activity on gas phase and surface reaction ignition temperatures was studied for H2, C3H8, and C2H6 air mixtures flowing over a platinum and a quartz surface. The gas phase ignition temperature is a function of catalyst surface reactivity. That is at lower temperatures the quartz surface was essentially noncatalytic and resulted in gas phase ignition temperatures up to 100 K lower than with the platinum surface. At increased surface temperatures the catalytic activity of the quartz surface approached that of the platinum and gas phase ignition temperatures were identical for both surfaces. DOE

N80-31514# Polytechnic Inst. of New York, Farmingdale. Aerodynamics Labs.
COMPLETE BURNING AND EXTINCTION OF A CARBON PARTICLE IN AN OXIDIZING ATMOSPHERE
Moshe Matalon May 1980 46 p refs
(Contract ET-78-C-01-3084)
(FE-3084) Avail: NTIS HC A03/MF A01

The departure from an equilibrium gas phase behavior is described in order to obtain the rate of mass loss M of a pure carbon particle immersed in an oxidizing atmosphere over a wide range of Damkoehler numbers D/sub g/ (representing either the particle size or the ambient pressure). The analysis allowed a small leakage of oxygen through the flame so that M depended on the direct oxidation C + O2 as well. The structure of a thin but finite flame where the CO oxidation takes place was analyzed and its influence on M was determined. When the flame exists, it stands at a well defined distance from the particle and in particular it can be adjacent to it; this depends on the particle size and on its surface temperature. DOE

N80-31515# Oak Ridge National Lab., Tenn. Chemical Technology Div.

COMPUTER SIMULATION OF DISPLACEMENT CATION EXCHANGE CHROMATOGRAPHY: SEPARATION OF TRIVALENT ACTINIDES AND LANTHANIDES

C. W. Forsberg May 1980 84 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6738) Avail: NTIS HC A05/MF A01

A first generation mathematical model of displacement cation exchange chromatography (CES) was constructed. The model incorporated the following phenomena: diffusion of cations up and down the column, diffusion of cations from the bulk liquid to the resin surface, and equilibrium of cations between liquid and solid resin beads. A limited number of experiments with rare earths using DTPA as the separation agent were undertaken to increase the current understanding of the processes involved in cation exchange chromatography. The numerical computer program based on the mathematical model was written in FORTRAN IV for use on the IBM 360 series of computers. DOE

N80-31516# Illinois Inst. of Tech., Chicago. Dept. of Chemistry.

STUDIES OF COMBUSTION KINETICS AND MECHANISMS Progress Report, 1 Jun. 1978 - 31 May 1980

David Gutman 30 Jan. 1980 7 p
(Contracts DE-AS02-78ER-14953; ET-78-S-02-4953)
(DOE/ER-14953/T1) Avail: NTIS HC A02/MF A01

A pulsed CO2-TEA laser was used to dissociate free radical precursors, and a photoionization mass spectrometer is used to monitor the reactions of the radicals. Laser-induced decompositions of ethyl acetate, trifluoroiodomethane, ethyl nitrate, and dimethylsulfoxide were carried out. DOE

N80-31517# Oak Ridge National Lab., Tenn. Computer Sciences Div.

RESIN BEAD U AND PU ANALYSIS OF WAK INPUT SOLUTIONS: A STATISTICAL SUMMARY OF EXPERIMENT NO. 1

C. K. Bayne, J. A. Carter, D. H. Smith, and R. L. Walker Jun. 1980 45 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7362; ISPO-99) Avail: NTIS HC A03/MF A01

A statistical analysis of the resin bead experimental data was made to identify sources of variations among the measurements of isotopic atom ratios and elemental concentrations of plutonium and uranium. Comparisons among treatment means of the analytical laboratory and the resin bead preparation methods are tabulated using Duncan's multiple range test. DOE

N80-31518# Los Alamos Scientific Lab., N. Mex.

INFRARED ANALYSIS OF COAL GASIFIER PRODUCT GASES

R. F. Holland, G. P. Quigley, and M. C. Vasquez 1980 11 p refs Presented at the Symp. on Instrumentation and Control for Fossil Energy Processes, Virginia Beach, Va., 9 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1625; CONF-800602-6) Avail: NTIS HC A02/MF A01

Infrared absorption measurements using a Fourier transform infrared spectrometer were found to be a convenient way to measure the concentration of certain infrared absorbing gases always present in a coal gasifier product steam. Preliminary measurements using this technique with gas mixtures representative of gasifier products in high pressure, statically filled cells are described. DOE

N80-31519# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A PREDICTION MODEL FOR TURBULENT DIFFUSION FLAMES, INCLUDING NO-FORMATION

J. Janicka (Technische Hochschule, Aachen) and W. Kollmann Sep. 1979 17 p refs Presented at AGARD-PEP 54th Specialists' Meeting on Combustor Modeling, Cologne, 3-5 Oct. 1979 Submitted for publication
(VKI-Preprint-1979-14) Avail: NTIS HC A02/MF A01

A prediction model for turbulent diffusion flames burning gaseous fuels was developed and applied to H2-air flames. In the simplified system of chemical reactions the fast reactions are assumed to be in equilibrium whereas three-body recombinations are treated in nonequilibrium. For the H2-air flames this assumption leads to a description of the reacting system with only two variables: reaction fraction and reaction variable. Two methods of treating such a system in a turbulent flow are discussed. Two sets of equations are complemented with a modified version of the kinetic energy/dissipation rate turbulence model. The NO-formation in such flames can be calculated using the nonequilibrium values (mean values and covariances) of the O and H radicals. The results obtained with both models are compared with experiments and show good agreement.

Author (ESA)

N80-31520# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).

THE AUTOXIDATION OF HYDRAZINE AND ALKYL SUBSTITUTED HYDRAZINE VAPORS

J. M. Bellerby London HMSO May 1980 30 p refs
(PERME-Memo-92; BR74110) Avail: NTIS HC A03/MF A01

The existing body of experimental work on the kinetics of the low temperature autoxidation of hydrazine and the alkyl substituted hydrazines, monomethylhydrazine (MMH) and unsymmetrical dimethylhydrazine (UDMH), is reviewed. In the particular case of the UDMH/O2 reaction (for which the most reliable data are available) a mechanism is put forward which involves the initial formation, by a chain process, of a hydroperoxide. This intermediate is then assumed to undergo wall reactions to give the observed major products. It is further proposed that the hydroperoxide acts as a chain branching agent in the gas phase, thereby giving rise to autocatalysis. The consequences of autocatalysis are examined and seen to account for several previously unexplained features of the kinetic data on the UDMH autoxidation. A full scheme is then proposed for this reaction which successfully accounts for the major and minor products and for the overall stoichiometry. Author (ESA)

N80-31521# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.

APPLICATION OF PHYSIOCHEMICAL ANALYSIS METHODS TO FORMING STRATIFIED MATERIALS WITH HIGH TEMPERATURE ENERGY MATRICES [METHODES D'ANALYSES PHYSICO-CHIMIQUES APPLIQUEES AU MOULAGE DES STRATIFIES A MATRICE APOXY HAUTE TEMPERATURE]

Paul Hebrard Paris 1980 28 p In FRENCH Presented at Conf. on Journees d'Etudes Intern. du Verre Textile et des Plastiques Renforces, Paris, 16-17 Apr. 1980
(SNIAS-801-422-105) Avail: NTIS HC A03/MF A01

The techniques permit a nonporous, completely or sufficiently polymerized homogeneous material with an optimum fiber/matrix ratio to be obtained which is free from volatile matter. Methods employed include: thermogrammetry, differential microcalorimetry, and dynamic viscoelastic analysis. Tables of results relating to specific materials are given together with a series of graphs representing the various corresponding thermal and mechanical characteristics. The use of such methods leads to a high degree of reliability in the fabriction process and to the production of materials of guaranteed quality. Author (ESA)

N80-31522# Environmental Research Lab., Athens, Ga. Analytical Chemistry Branch.

ION CHROMATOGRAPHY OF ANIONS Interim Report, Jul. 1978 - Jul. 1979

Thomas B. Hoover and George D. Yager Mar. 1980 44 p refs
(PB80-184450; EPA-600/4-80-020) Avail: NTIS HC A03/MF A01 CSCL 07D

A Dionex model 10 ion chromatograph was evaluated for the measurement of anionic species in water. The theoretical effect of hydrogen ion activity (pH) on the elution time of phosphate and arsenate was tested and emprical selectivity coefficients was determined for the major protolytic species of these acids. Calibration curves were obtained several anions by direct injection of 0.1 mL of standards. Detection limits for ions other than chloride were approximatley 0.2 micrograms independent of the method of sample introduction. For chloride the detection limit was 2 ng, by direct injection. The concentrator column permitted determination of any of the above ions at concentrations greater than to micrograms/L. GRA

N80-31523# Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
PHYSICAL PROPERTIES AND STABILITY OF WATER IN FUEL OIL EMULSIONS Final Report, Aug. 1978 - Aug. 1979
H. S. Fogler, S. R. Reddy, S. C. Siegmund, and M. A. Palazzolo Jan. 1980 146 p refs
(Contract DOT-OS-70056)
(PB80-184203; UMICH-015657; DOT-SPA-DPB-50-79-16) Avail: NTIS HC A07/MF A01 CSCL 07D

Ultrasonically induced interfacial instability and cavitation were used to produce emulsions of water-in-gasoline, no. 2 diesel oil, no. 4 heating oil and no. 6 fuel oil without the addition of surfactants. Compressibility measurements are presented for each of the four fuel oils as a function of water volume fraction. Measurements are also presented for no. 4 heating oil as a function of temperature. Corrosion rates for mild steel were measured in emulsions of rates for mile steel were measured in emulsions of no. 6 fuel oil at 10% volume fraction of water at 70 C and 90 C. The viscosity of oil-in-water emulsions was studied as a function of volume fraction of oil and of particle size distribution of oil in the emulsions. The stability of the oil-in-water emulsion was studied for the case of simultaneous creaming and flocculation. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-31524 Iowa State Univ. of Science and Technology, Ames.
FAST DIFFUSION AND ELECTROMIGRATION OF METALLIC SOLUTES IN THORIUM Ph.D. Thesis
William Nile Weins 1980 90 p
Avail: Univ. Microfilms Order No. 8019675

The electrotransport and chemical diffusion of iron, cobalt, and nickel in thorium are described. The transport parameters D and Z were measured in both alpha and beta-thorium. The experimental results indicate that these solutes are fast-diffusing species in alpha-thorium. The internal friction behavior associated with these solutes in thorium was investigated. Results indicate that there are two relaxation peaks associated with each of these solutes in thorium. Experimental values of the activation energy associated with one of the relaxation peaks are coincident with the values of activation energy for diffusion and suggest that both processes are controlled by the same mechanism. Considerations of other data indicate that this mechanism involves an interstitial defect. Dissert. Abstr.

N80-31525 Polytechnic Inst. of New York.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE MECHANICAL BEHAVIOR OF ALPHA-BETA TiMn ALLOYS Ph.D. Thesis
Sreeramamurthy Ankem 1980 248 p
Avail: Univ. Microfilms Order No. 8019386

Elastic interactions at the Widmanstatten alpha-beta titanium alloy interfaces that rise due to compatibility requirements have been calculated for various orientations if the interface with respect to the stress axis. The stress and strain distributions in alpha-beta Ti-Mn alloys have been calculated as a function of strain, volume fraction of phases, and particle size. Near the interface, strains in beta are higher than they are away from the interface. In alpha the strains are lower near the interface. Stresses have the same behavior as the strains. The average strain in alpha is higher than the average strain in beta. The ratio of the strain in alpha, epsilon sub alpha, to the strain in beta, epsilon sub beta is minimum for a given strain near 50 volume percent of beta. This ratio increases with strain up to 25% the limit of total strain examined. The ratio decreases with decreasing particle size and uniformity of strain increases with decreasing particle size. Interface sliding was more prominent in Wid structures than equiaxed structures. Various room temperature tensile properties have been determined for both Wid. alpha and equiaxed alpha microstructures for six Ti-Mn alloys. Dissert. Abstr.

N80-31526 Utah Univ., Salt Lake City.
THE EFFECT OF MIXED TRANSITION-METAL DOPANTS ON THE HIGH TEMPERATURE CREEP OF POLYCRYSTALLINE ALUMINA Ph.D. Thesis
Yasuro Ikuma 1980 165 p
Avail: Univ. Microfilms Order No. 8019063

High density (-99%) polycrystalline alumina doped with transition metal impurities (Fe and/or Ti, Mn + Ti, and Mg and/or Ti) was fabricated by hot pressing. Creep tests were performed on this material using a four point bend dead load technique. A range of grain sizes (5 to 300 micrometers), temperatures (1100 to 1500 C), stresses (2-17 MN/square meters and oxygen partial pressures (10 to the minus 11th power - 0.86 atm) was studied. The Mn + Ti dopant couple is by far the most effective in enhancing the creep rate of polycrystalline alumina. A creep deformation map was constructed in which constant strain rate lines were computed for variable grain sizes and impurity content. In this type of creep mapping, the range of variable over which interfacial (grain boundary) defect annihilation processes become important in diffusional creep is clearly illustrated. Dissert. Abstr.

N80-31527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHERENCE OF ION BEAM SPUTTER DEPOSITED METAL FILMS ON H-13 STEEL
Michael J. Mirtich 1980 17 p refs Presented at the 27th Natl. Am. Vacuum Soc. Symp., Detroit, 14-17 Oct. 1980
(NASA-TM-81585; E-562) Avail: NTIS HC A02/MF A01 CSCL 11F

An electron bombardment argon ion source was used to sputter deposit 17 different metal and metal oxide films ranging in thickness from 1 to 8 micrometers on H-13 steel substrates. The film adherence to the substrate surface was measured using a tensile test apparatus. Comparisons in bond strength were made between ion beam, ion plating, and RF deposited films. A protective coating to prevent heat checking in H-13 steel dies used for aluminum die casting was studied. The results of exposing the coated substrates to temperatures up to 700 degrees are presented. R.K.G.

N80-31528*# National Materials Advisory Board, Washington, D. C.
AMORPHOUS AND METASTABLE MICROCRYSTALLINE RAPIDLY SOLIDIFIED ALLOYS: STATUS AND POTENTIAL Final Report
Nicholas J. Grant, Carl F. Cline, Lance A. Davis, Bernard H. Kear, and Fred E. Luborsky May 1980 170 p refs Sponsored in part by NASA
(Contract MDA903-78-C-0038)
(NASA-CR-163449; AD-A086000; NMAB-358) Avail: NTIS HC A08/MF A01 CSCL 11/6

The nature, properties, processing, and possible applications of two classes of materials are described: amorphous solids, particularly glassy metals, and metastable microcrystalline alloys. The thermodynamics and structural considerations of both amorphous and metastable metals and nonmetals are discussed in detail. The chemistry and properties of systems for which data are available also are described as are the processing limitations and methods. Application possibilities are discussed, and the report concludes with recommendations for research and development. GRA

N80-31529# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
ORGANIC METALS AND SEMICONDUCTORS: THE CHEMISTRY OF POLYACETYLENE (CH)X, AND ITS DERIVATIVES Interim Technical Report
Alan G. Macdiarmid and Alan J. Heeger 24 Nov. 1979 13 p refs Presented at the 3d Intern. Congr. of Quantum Chem., Kyoto, Japan, Oct. 1979
(Contract N00014-75-C-0962)
(AD-A087054; TR-79-11) Avail: NTIS HC A02/MF A01 CSCL 11/9

Polyacetylene is quite remarkable in that its conductivity can be readily modified to span an extraordinarily large range. Considering possible polyacetylene derivatives, replacement of some or all of the hydrogen atoms in polyacetylene with organic

or inorganic groups, copolymerization of acetylene with other acetylenes or olefins, and the use of different dopants should lead to the development of a large new class of conducting organic polymers with electrical properties that can be controlled over the full range from insulator to semiconductor to metal. Furthermore, there is considerable potential for the possible application of a parent or doped polyacetylene to the fabrication of various types of electronic devices, solar cells, etc. GRA

N80-31530# Boeing Military Airplane Development, Seattle, Wash. Advanced Aircraft Branch.

CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST) STRUCTURAL TEST AND EVALUATION, PHASE 5. PART 2: FATIGUE AND FRACTURE PROPERTIES OF CAST ALUMINUM BULKHEADS Final Report, Feb. 1977 - Jan. 1980

Christian K. Gunther Apr. 1980 72 p refs

(Contract F33615-76-C-3111; AF Proj. 486U; AF Proj. 485U)

(AD-A087336; D180-25724-2; AFWAL-TR-80-3021-PT-2)

Avail: NTIS HC A04/MF A01 CSCL 11/6

The fatigue and fracture properties of four cast A357-T6 aluminum alloy bulkheads were investigated. Constant amplitude fatigue, crack growth, and fracture toughness specimens were excised from the bulkheads for this purpose. The data obtained from these specimens confirmed the assumed properties used in the durability and damage tolerance analyses of the bulkhead. GRA

N80-31531# Boeing Military Airplane Development, Seattle, Wash. Advanced Airplane Branch.

CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST) STRUCTURAL TEST AND EVALUATION, PHASE 5. PART 3: STATIC PROPERTY ALLOWABLES Final Report, Jun. 1976 - Aug. 1979

Dale L. McLellan Apr. 1980 144 p refs

(Contract F33615-76-C-3111; AF Proj. 486U; AF Proj. 485U)

(AD-A087337; D180-25724-3; AFWAL-TR-80-3021-Pt-3)

Avail: NTIS HC A07/MF A01 CSCL 11/6

This document contains static mechanical properties of A257-T6 aluminum alloy castings. Properties of castings are relatable to non-destructively measured soundness and aluminum dendrite size. A criterion is developed for design properties in terms of these physical parameters applicable to all castings of the same alloy and temper regardless of size, shape, method of production, mold materials or other process variables. GRA

N80-31532# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.

[TRAPPING BY TiC PARTICLES AND TWIN FORMATION IN Fe-Ti] Status Report, 1 Nov. 1979 - 30 Apr. 1980

30 Apr. 1980 10 p refs

(Contract N00014-75-C-0265)

(AD-A085998) Avail: NTIS HC A02/MF A01 CSCL 11/6

The resistance of an HSLA steel to hydrogen embrittlement was studied and were correlated to hydrogen diffusivity data and microstructural analysis with the observed mechanical behavior of the alloy containing internal hydrogen. The effect of microstructure on subsequent hydrogen transport in the alloy with a composition of 1.37% Mn, 0.22% Ti, 0.64% C and 0.26% Si was investigated. All specimens were solution annealed followed by quenching and aging at temperatures from 600 C to 900 C. Since the only considerable change in the microstructure for heat treatments, compared to the the as-quenched condition, is the nucleation and growth of TiC particles, it is reasonable to believe that they are responsible for the irreversible trapping. After ambient cathodic charging of hydrogen into three different titanium and carbon content iron alloys, only one showed twinning formation. For all charging times of this alloys, twins were found at or near TiC particles with the size of twins increasing as the amount of hydrogen increased. A.R.H.

N80-31533# Massachusetts Inst. of Tech., Cambridge. Corrosion Lab.

HYDROGEN INDUCED INTERGRANULAR CRACKING OF NICKEL-BASE ALLOYS

M. Kurkela, T. S. F. Lee, and R. M. Latanision Jul. 1980 107 p refs

(Contract N00014-78-C-0002; NR Proj. 036-127)

(AD-A087305; TR-4) Avail: NTIS HC A06/MF A01 CSCL 11/6

This report is intended to summarize the activities pursued during the second year of a program directed toward an evaluation of the susceptibility of nickel and nickel base alloys to embrittlement by cathodically produced hydrogen. GRA

N80-31534# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS

R. E. Lewis Jun. 1980 15 p refs

(Contract F33615-78-C-5203; DARPA Order 3417)

(AD-A087401; LMSC-D770654) Avail: NTIS HC A02/MF A01 CSCL 11/6

Advanced aluminum alloys are to be developed that will provide major payoffs for important new aircraft, spacecraft, and missile systems in the next decade. Payoffs will result from weight savings of structural components which, in turn, lead to increased range, payload, service life, and decreased life-cycle cost. The objective of this program is to develop advanced aluminum alloys from rapidly solidified particulate that meet specific property goals. In addition, the program is to establish a metallurgical basis suitable for manufacturing scale-up and application to new weapon systems. GRA

N80-31535# Boeing Military Airplane Development, Seattle, Wash. Advanced Aircraft Branch.

CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST). PHASE 5: STRUCTURAL TEST AND EVALUATION. PART 1: FULL SCALE TEST Final Report, Feb. 1977 - Jan. 1980

Christian K. Gunther Apr. 1980 114 p refs

(Contract F33615-76-C-3111; AF Proj. 486U; AF Proj. 485U)

(AD-A087807; D180-25724-1; AFWAL-TR-80-3021-Pt-1)

Avail: NTIS HC A06/MF A01 CSCL 11/6

Full scale tests were conducted on the cast A357-T6 aluminum alloy bulkheads developed and manufactured for the Cast Aluminum Structures Technology (CAST) program. One test article was subjected to four lifetimes of durability and damage tolerance testing and a second was subjected to additional two lives of damage tolerance testing including residual strength tests to and exceeding ultimate loads. The full scale test program successfully demonstrated that the static strength, durability, and damage tolerance requirements for the bulkhead were met. GRA

N80-31536# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

TRANSPIRATION-COOLED NOSETIP DEVELOPMENT Final Report, Jul. 1978 - Jan. 1980

N. C. Campbell, G. F. Pittinato, and M. T. Martin Jun. 1980 111 p

(Contract DAAG46-78-C-0034; DA Proj. 1W1-62113-A-661)

(AD-A087837; AMMRC-TR-80-30) Avail: NTIS HC A06/MF A01 CSCL 11/6

A 316L stainless steel transpiration cooled nosetip for a high performance missile system was designed and fabricated using powder metallurgy techniques. The geometry of the nosetip was established, and permeability requirements were analytically defined. A parametric study of subscale billets determined permeability as a function of powder size and sintering temperature. Near-net-shape billets were fabricated, and machining procedures for the porous material were established. A comparison was made between the actual and calculated gas flow through the nosetip over its entire surface. Two nosetips were successfully tested in a thermal environment approximating the flight environment at the Edwards Air Force Base Rocket Propulsion Laboratory (RPL). Tests were conducted at 0 degree and 10 degree angles of attack. GRA

N80-31537# International Nickel Co., Inc., Suffern, N. Y. Research and Development Center.

METALLURGICAL STUDIES OF HYDROGEN STORAGE ALLOYS Final Report

Apr. 1980 218 p refs

(Contract DE-AC02-76CH-00016)

(DOE/CS-0016/T2) Avail: NTIS HC A10/MF A01

The surface poisoning of metal hydrides by impurities in the

hydrogen used. Alloys investigated were LAN15, FeTi, and Fe Mn Ti. Gaseous impurities studied were 02, H20, and Co. The nature of the surface structures formed, and consequently the degree of poisoning varies markedly from alloy to alloy and from impurity to impurity. A number of rate limiting reaction steps are apparent and examples of complex compound film formation, chemisorption, and possibly physisorption can be seen. Results show the hope of developing surface structures with significant resistance to impurity gases and especially the possibility of designing practical regeneration cycles. DOE

N80-31538# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
METALLURGICAL ANALYSIS AND HIGH TEMPERATURE DEGRADATION OF THE BLACK CHROME SELECTIVE ABSORBER
Carl M. Lampert Mar. 1980 19 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr., 1980 Submitted for publication
(Contract W-7405-eng-48)
(LBL-10293; CONF-800439-6) Avail: NTIS HC A02/MF A01

A well known coating, Harshaw Chemical Company's Chromonyx was selected for detailed scrutiny of its properties and degradation modes when exposed to high temperatures. Both aspleted and annealed microstructural models were presented. Technical means used in this microstructural characterization were: scanning and transmission electron microscopy, Auger depth profiling hemispherical reflectance and energy dispersive X-ray analysis. From these results a physical metallurgical model for wavelength selective properties of the coating was developed. Thus, it was observed that black chrome degraded as Cr2O3 oxide particles grew and chromium depleted. This effect was pronounced in air and to a lesser degree in medium vacuum. Oxidation by preferential diffusion and outgassing which causes structural changes, may take place. DOE

N80-31539# General Atomic Co., San Diego, Calif.
EFFECTS OF SURFACE CONDITION ON THE CORROSION OF CANDIDATE STRUCTURAL MATERIALS IN A SIMULATED HTGR-GT ENVIRONMENT
L. D. Thompson Feb. 1980 107 p refs
(Contract EY-76-C-03-0167; GA Proj. 6400)
(GA-A-15873) Avail: NTIS HC A06/MF A01

A simulated high temperature gas cooled reactor helium environment was used to study the effects of surface finish conditions on the subsequent elevated temperature corrosion behavior of key candidate structural materials. The environment contained helium with 500 micro-atmospheres H2/50 micro-atmospheres CO/50 micro-atmospheres CH4/<0.5 micro-atmospheres H20 at 900 C with total test exposure durations of 3000 hours. Specimens with lapped, grit-blasted, pickled, and preoxidized surface conditions were studied. Materials tested included two cast superalloys, IN 100 and IN 713LC; one centrifugally cast high temperature alloy, HK 40 one oxide dispersion strengthened alloy, Inconel MA 754; and three wrought high temperature alloys, Hastelloy Alloy X, Inconel Alloy 617, and Alloy 800H. DOE

N80-31540# General Atomic Co., San Diego, Calif.
CARBURIZATION OF AUSTENITIC ALLOYS BY GASEOUS IMPURITIES IN HELIUM
G. Y. Lai and W. R. Johnson Mar. 1980 48 p refs Submitted for publication
(Contract DE-AT03-76ET-35300; GA Proj. 6400)
(GA-A-15790) Avail: NTIS HC A03/MF A01

Corrosion tests of Alloy 800H, Inconel Alloy 617 and Hastelloy Alloy X in helium containing various amounts of H2, CO, CH4, H2O and CO2 were conducted in a temperature range from 649 C to 1000 C for exposure time up to 10,000 hr. Four different helium environments were investigated. The results show that the carburization kinetics in low oxygen potential environments are significantly higher, approximately an order of magnitude higher at high temperatures, than those in high oxygen potential environments for all three alloys. Thermodynamic analyses indicated no significant differences in the thermodynamic carburization potential between low and high oxygen potential environments. It is believed that the enhanced carburization kinetics observed in the low oxygen potential environments were related to kinetic effects. A qualitatively mechanistic model was proposed to explain the enhanced kinetics. The present results further suggest that controlling the oxygen potential of the service environment can be an effective means of reducing carburization of alloys. DOE

N80-31541# Aluminum Co. of America, Alcoa Center, Pa.
PRODUCTION OF ALUMINUM-SILICON ALLOY AND AND FERROSILICON AND COMMERCIAL PURITY ALUMINUM BY THE DIRECT REDUCTION PROCESS Interim Technical Report, 1 Jun. - 31 Aug. 1979
M. J. Bruno Sep. 1979 22 p
(Contract EC-77-C-01-5089)
(CONS-5089-8; ITR-4) Avail: NTIS HC A02/MF A01

Burden materials ground to -65 mesh prior to agglomeration compared favorably to -200 mesh grinds. Ball forming agglomeration was developed for bauxite-clay-coke mixes. The balls produced had higher strength and abrasion resistance than extrusions made from the same formulations. Neutron activation analysis for Al, Si, Fe and oxygen combined with the analysis of Ti by atomic absorption and carbon by combustion provided the best analytical procedure for reactor metal samples. Continuous, steady-state operation produced significant quantities of coalesced metal alloy; individual metal yields for Al, Si, Fe and Ti ranged from 64 to 93%. The mechanical Auger minimized burden bridging during the induction heated runs. Extensive phase analyses were completed on metal product samples by optical microscope techniques, resulting in identification of phases and understanding of relationships between phases formed. DOE

N80-31542# Northwestern Univ., Evanston, Ill.
INVESTIGATION OF DISPERSED IRON ALLOY CATALYST IN THE CARBON MONOXIDE-HYDROGEN SYNTHESIS REACTION Progress Report, 1 Aug. 1979 - 31 Jul. 1980
John B. Butt and Lyle H. Schwartz Apr. 1980 12 p refs
(Contract DE-AC02-76ER-04993)
(COO-4993-2) Avail: NTIS HC A02/MF A01

A series of Fe-Ni, Fe-Co, Fe-Cu and Fe-K catalysts supported on SiO2 were prepared, characterized, and investigated with respect to activity and selectivity in CO-H2 synthesis. Several silica supported iron nitrides were also prepared and characterized. Efforts directed toward the identification of the particle sizes and phases formed upon preparation, calcination, reduction and carburization are described. It was found that the conditions of preparation strongly affect the nature of the resulting catalyst, both with respect to alloy homogeneity, metal particle size, and catalytic activity. For the Fe system in particular, standard methods of preparation via impregnation and calcination result in very large particle (ca. 80 nm) composites of smaller individual grains (ca. 10 nm). Characterization via X-ray or Moessbauer, however, reveals only the characteristic dimension of the granules and not of the composite particles. DOE

N80-31543# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
STRAIN HARDENING AND DUCTILITY OF IRON: AXISYMMETRIC vs PLANE STRAIN ELONGATION
George Langford May 1980 72 p refs
(Contract DE-AC02-76ER-04072)
(DOE/ER-04072/3) Avail: NTIS HC A04/MF A01

The strain hardening of iron at high strains in plane strain elongation (strip drawing) is shown to fall increasingly below that of drawn iron wires at true strains above 2, going through zero strain hardening at epsilon = 3.0, and becoming strongly negative thereafter, at least up to epsilon = 4.1. High resolution selected area electron diffraction was used to map the size, shape and crystallographic orientations of a group of about 50 contiguous cells centered around an incipient shear band in an edge section of a strip drawn to epsilon = 1.8. This map shows no textural instability or change in orientation associated with the shear band, although it does show substantial misorientations throughout the group of cells, the axis of these misorientations lying in the same directions as the trace of the shear band. The only instability seen in this shear band is microstructural: the slip distances in the two primary slip directions are quite anisotropic, being much longer along the trace of the shear band. DOE

N80-31544# Teel (R. B.) and Associates, Chatham, N.J.

STRESS-CORROSION CRACKING OF STEELS IN AMMONIA: A SURVEY WITH CONSIDERATION ON GIVEN OTEC DESIGN

R. B. Teel (Teel R. B. and Associates) ANL Mar. 1980 44 p refs

(Contract W-31-109-eng-38)

(ANL/OTEC-BCM-008) Avail: NTIS HC A03/MF A01

Carbon steel, alloy steel, and high-strength, quenched and tempered steel, when under applied or residual stress and *especially when cold formed and/or welded without subsequent* thermal stress relief, are subject to failure by stress-corrosion cracking (SCC) in air contaminated dry ammonia. Water as well *as hydrazine when present in small amounts are effective inhibitors* in an all steel system. Where water has proven effective as an inhibitor of SCC in an all steel system, it may not be adequate in a mixed metal system. With aluminum tubes, the tube sheet will either have to be solid aluminum, aluminum clad steel, or *some nonconductive coating will be necessary to effectively remove the cathodic alloy from the galvanic circuit. Research is* required to determine the severity of the coupling effect between *dissimilar alloys in ammonia especially the possibility of accelerated* SCC failures of stressed steel where the presence of an inhibitor in the ammonia may not be sufficient to override the *galvanic coupling effect.* DOE

N80-31545# Defence Research Information Centre, Orpington (England).

A STUDY ON MECHANICAL PROPERTIES OF HEAVY ALLOYS

Eun Chung and Dong Nyung Lee London Feb. 1980 19 p refs Transl. into ENGLISH from Taehan Kunsok Hakhoe Chi (Korea), v. 17, no. 1, 1978 p 38-45 Sponsored by UK Minister of Education

(DRIC-T-5966; BR73104) Avail: NTIS HC A02/MF A01

Liquid phase sintering of four tungsten alloys was studied. Mechanical properties and hardness were examined. The compositions of the alloys were respectively: (1) 94% W-3% Ni-3% Fe, (2) 94% W-2.5% Ni-2.5% Fe-1% Co, (3) 94% W-2.5% Ni-2.5% Fe-1% Mo, (4) 94% W-2.5% Ni-2.5% Fe-1% Mn. It was found that coarsening of tungsten particles in the specimens during sintering followed the diffusion controlled growth mechanism, and that hardness decreased with increased sintering time. Author (ESA)

N80-31546# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.

THE ROLE OF ELECTRON MICROSCOPY BY TRANSMISSION IN THE STUDY OF RADIATION DAMAGE IN METALS [*IL RUOLO DELLA MICROSCOPIA ELETTRONICA PER TRASMISSIONE NELLO STUDIO DEI DANNI DA RADIAZIONE NEI METALLI*]

G. Chevallard and D. Wenger Dec. 1979 67 p refs

(CISE-1541) Avail: NTIS HC A05/MF A01

The applications of transmission electron microscopy to the study of radiation damage in metals are discussed. The principles of this technique are reviewed and the method compared with other methods. The interpretation of the micrography contrast effects due to metal defects and the interpretation rules used to identify these defects are examined. The defect population analysis, *necessary for the characterization of the microstructure before* and after the irradiation, is discussed. Author (ESA)

N80-31547# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.

ELECTRONIC PROPERTIES OF MATERIALS AND CORROSION PHENOMENA. A NONCONVENTIONAL APPROACH TO THE MECHANISM OF STRESS CORROSION CRACKING [*PROPRIETA ELETTRONICHE DEI MATERIALI E FENOMENI* DI CORROSIONE. UN APPROCCIO NON CONVENZIONALE AI MECCANISMI DI STRESS CORROSION CRACKING]

M. Martinelli and C. Ronchetti Nov. 1978 59 p *refs* In ITALIAN; ENGLISH summary

(CISE-N-188) Avail: NTIS HC A04/MF A01

The perturbations induced on metal free electrons by the mechanical stress state are analyzed, as well as the consequences of such perturbations on the metal-solution interface and then on the electrochemical parameters. It is found that the metal strain state, both from an elastic and a plastic standpoint, has remarkable effects on the metal fermi energy and work function and that such effects influence the redox potential of an electrode made up with the same material. A working hypothesis is formulated, where the modification of the metal electronic state is the main cause for the onset of material areas with a different electrochemical behavior. Author (ESA)

N80-31548# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

COMPARISON OF FRACTURE TOUGHNESS IN TITANIUM ALLOYS IMI 550 AND IMI 551

R. J. H. Wanhill 14 May 1980 21 p refs

(Contract *NIVR-1696*)

(NLR-TR-78143-U) Avail: NTIS HC A02/MF A01

Fracture toughness tests on two high strength titanium alloys, IMI 550 and 551, showed that the higher strength alloy, IMI 551, had a much lower toughness. The alloys were very similar *in microstructure and fracture mechanisms. A number of model* formulations for predicting fracture toughness were compared with the experimental results. This comparison indicated a number *of parameters to be important, namely yield stress, elastic modulus,* plane strain fracture strain, strain hardening exponent, and microvoid (dimple) diameter. The observed increase in fracture *strain, dimple diameter, and fracture toughness with decreasing* strength can be rationalized by voids occuring earlier during deformation and by voids initiating at many sites inactive in the lower strength material. Author (ESA)

N80-31549# Texas Engineering Experiment Station, College Station. Industrial Economics Research Div.

GULF COAST MANGANESE NODULE PROCESSING PLANT LOCATION CRITERIA

Daniel Bragg Aug. 1979 167 p

(Grant NOAA-04-7-158-44105)

(PB80-182082; NOAA-80041102) Avail: NTIS HC A08/MF A01 CSCL 11F

A number of physical, economic, regulatory and attitudinal characteristics of the coastal area of five states making up the Gulf Coast region of the U.S. are examined. This effort was directed at identifying those areas suitable for further study as *potential locations for onshore manganese nodule processing* plants. It was concluded that: the impact of the proposed plants will be no different than that of most large process-type plants already in operation in the region; the benefits of the proposed plants should more than offset the demand for local, tax supported services. Early interaction between government and private enterprise should help assure the development of a commercially viable, environmentally compatible nodule processing industry. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-31550 Lehigh Univ., Bethlehem, Pa.

***THE FATIGUE CRACK PROPAGATION BEHAVIOR OF SEMI-CRYSTALLINE POLYMERS* Ph.D. Thesis**

Philip Eric Bretz 1980 206 p

Avail: Univ. Microfilms Order No. 8019707

The effect of molecular weight (MW) and plasticizer content on the fatigue crack propagation (FCP) response of semi-crystalline polymers is evaluated. In addition, a comprehensive comparison of crack growth rates in amorphous and semi-crystalline polymers *is made. Fatigue tests were performed on specimens of nylon* 66 (N66) and polyacetal (PA) ranging in MW from 17,000-34,000 and 30,000-70,000, respectively. While *toughness increased by 30% with MW in this range, crack growth* rates decreased by a factor of 3.5 in N66 and a factor of 5 in PA. As for the effect of plasticization, crack tip blunting dominated at low water contents (< or = 2.5%) and reduced FCP rates, while the modulus decrement at higher moisture levels accelerated crack velocity. A comparison of crack growth rates for semi-crystalline and amorphous polymers confirmed the

superior fatigue resistance of the multi-phase materials. A positive correlation between reduced FCP rates and increased toughness was observed for semi-crystalline polymers. Fracture surface morphology was examined to ascertain the mechanisms of cyclic damage and fatigue crack propagation. Dissert. Abstr.

N80-31551*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PHOSPHORUS-CONTAINING BISIMIDE RESINS Patent Application

Indra K. Varma (National Academy of Science - National Research Council, Washington, D.C.), George M. Fohlen, and John A. Parker, inventors (to NASA) Filed 5 Aug. 1980 12 p (NASA-Case-ARC-11321-1; US-Patent-Appl-SN-175452) Avail: NTIS HC A02/MF A01 CSCL 07C

Fire resistant resins particularly useful for making laminates with inorganic fibers such as graphite fibers are made by condensation of an ethylenically unsaturated cyclic anhydride with bis (diaminophenyl) phosphine oxide, and by addition polymerization of the bisimide so obtained. Up to about 50%, on a molar basis, of benzophenonetetracarboxylic acid anhydride can be substituted for some of the cyclic anhydride to alter the properties of the products. Graphite cloth laminates made with these resins have shown 800 C char yields greater than 70% by weight in nitrogen. Limiting oxygen indexes of more than 10% were determined for these resins. NASA

N80-31552*# AiResearch Mfg. Co., Phoenix, Ariz.

THE 3500 HOUR DURABILITY TESTING OF COMMERCIAL CERAMIC MATERIALS Interim Report

W. D. Carruthers, D. W. Richerson, and K. W. Benn Jul. 1980 237 p refs

(Contracts DEN3-27; EC-77-A-31-1040) (NASA-CR-159785; DOE/NASA/0027-80/1; AiResearch-31-3575A) Avail: NTIS HC A11/MF A01 CSCL 11B

A two year durability testing program to evaluate four commercially available ceramic materials under simulated automotive gas turbine combustor discharge conditions was conducted. Conditions included extended cyclic thermal exposures up to 2500 F and 3500 hours. Selected for evaluation were Norton NCX-34 hot pressed silicon nitride, AiResearch RBN 101 reaction bonded silicon nitride, Carborundum pressureless sintered d-siC and British Nuclear Fuels, Ltd. Retel reaction sintered silicon carbide marketed by Pure Carbon Co. These materials initially were exposed to 350 hours/1750 cycles at 1200 and 1270 C (2200 and 2500 F). Subsequent exposure to 1050, 2100, and 3500 hours were performed on the materials maintaining 50 percent of baseline strength after the initial exposure. Additional evaluations of exposed bars included dimension changes, weight changes, dye penetrant, specific damping capacity changes, scanning electron microscope fractography and X-ray diffraction. S.F.

N80-31553# Union Carbide Corp., Parma, Ohio. Carbon Products Div.

ACTIVATED CARBON FABRIC FROM PITCH Final Report, 15 Jun. 1978 - 14 Sep. 1979

S. M. Boszor Jun. 1980 39 p refs

(Contract DAAK60-78-C-0053; DA Proj. 1L1-62723-AH-98) (AD-A087030; PR-79-562; NATICK/TR-80/015; CE-MEL-214) Avail: NTIS HC A03/MF A01 CSCL 11/5

A project was undertaken to determine whether pitch-based carbon cloth could be made into an active cloth suitable for clothing protective against hazardous chemical environments. The experiments involved activating pitch-based cloth by standard methods in steam and CO2 in a laboratory reactor. Cloth with sorptivities exceeding 50% CCl4 by weight, surface areas exceeding 800 sq m/gm, and breaking strengths exceeding 5 kg per 25 mm wide strip were produced. Conditions were optimized to produce cloth of the highest area sorptivities for NARADCOM evaluation. GRA

N80-31554# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

EFFECT OF OXIDIZING FUELS ON AIRCRAFT FUEL SYSTEM ELASTOMERS AND SEALANTS Final Report

C. Nadler 20 May 1980 19 p ref

(AD-A087267; NADC-80076-60) Avail: NTIS HC A02/MF A01 CSCL 21/4

Jet fuels containing peroxides resulting from hydrogenation during refining have potential for damaging fuel system elastomeric components. Immersion tests were conducted for 1000 hours between 130 - 165 F in JP-5 containing 1, 5, and 10 meq. peroxide/1000 gm fuel with various fuel system sealants and elastomers. Damage thresholds were indicated and maximum allowable peroxide contents were recommended. GRA

N80-31555# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.

SEMICONDUCTING AND METALLIC COVALENT POLYMERS: (CH)x AND ITS DERIVATIVES Interim Technical Report

Alan G. MacDiarmid and Alan J. Heeger 8 Jul. 1980 13 p refs Presented at ACS Meeting, San Francisco, Sep. 1980

(Contract N00014-75-C-0962; NR Proj. 356-602) (AD-A086941; TR-80-5) Avail: NTIS HC A02/MF A01 CSCL 11/9

Polyacetylene, (CH)x, is the simplest possible conjugated organic polymer and is therefore of special fundamental interest. It can be prepared in the form of lustrous, silvery, flexible, polycrystalline films having any desired cis/trans content by catalytic polymerization of gaseous acetylene, C2H2. The cis-rich films can be stretched easily at room temperature in excess of three times their original length with concomitant partial alignment of the (CH)x fibrils. Dark red gels of toluene in (CH)x may be prepared using a lower catalyst concentration. Highly porous, very low density, 'foam-like' (CH)x can be obtained from these gels. Both cis- and trans-(CH)x are p-type semiconductors which can be treated with a variety of p- or n-type dopants with concomitant increase in conductivity to give a series of semiconductors and ultimately, 'organic metals'. This report will be directed primarily towards a description of the more chemically oriented aspects of (CH)x and its derivatives. GRA

N80-31556# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Materials Engineering.

FORMATION AND FAILURE OF ELASTOMER NETWORKS VIA THERMAL, MECHANICAL AND SURFACE CHARACTERIZATION Final Technical Report, 24 Aug. 1978 - 30 Jun. 1980

David W. Dwight and James E. McGrath Dec. 1979 61 p refs

(Contract DAAK30-78-C-0098) (AD-A087284; TARADCOM-12498) Avail: NTIS HC A04/MF A01 CSCL 11/10

This work focussed upon development of ESCA, SEM/EDAX, TGA, DSC and TMA methodologies for synthetic elastomer compounds typically used in tank track pad service by the U.S. Army. The initial goal was to develop a molecular model of the failure mechanisms that lead to costly pad replacement. Exploratory measurements were conducted on fully compounded, uncured rubber, and pre- and post-service track pads. Studied also were laboratory-prepared samples involving variable matrix (SBR, EPDM and 50/50 SBR/BR) as well as zinc oxide particle shape and size. An initial data base has been accumulated with surface and thermo-mechanical analysis that could provide useful structure-property information for further research and development of engineering elastomers. GRA

N80-31557# Pennsylvania Univ., Philadelphia. Lab. for Research on Structure of Matter.

ELECTRICAL TRANSPORTATION DOPED POLYACETYLENE Interim Report

Y. W. Park, A. J. Heeger, M. A. Ruy, and A. G. Macdiarmid 8 Jul. 1980 60 p refs Submitted for publication

(Contract N00014-75-C-0962; Grant NSF DMR-76-80994; NR Proj. 356-602) (AD-A087289; TR-80-4) Avail: NTIS HC A04/MF A01 CSCL 11/9

The results of an experimental study of electrical conductivity and thermopower in doped polyacetylene are reported. Included are measurements on both as-grown and partially oriented films doped with iodine and AsF6; (CH(AsF5)sub y)sub x and (CH(I3)sub y)sub x where y covers the full doping range. The data indicate three important concentration regimes; the dilute limit (y-0.001),

the transitional region (0.001-y-0.01), and the metallic state (y > 0.01. GRA

N80-31558# McDonnell Aircraft Co., St. Louis, Mo. Material and Process Development Dept.
CHEMICAL CHARACTERIZATION AND QUALITY CONTROL FOR AN ADHESIVE Final Report, 13 Nov. 1978 - 13 Feb. 1980
T. A. Sewell Feb. 1980 48 p refs
(Contract N00019-79-C-0064)
(AD-A087739) Avail: NTIS HC A03/MF A01 CSCL 11/1

The objective of this program has been to develop analytical test methods applicable to an adhesive system and demonstrate the viability of these techniques for in-plant quality control and to establish acceptance criteria with statistically valid accept/reject limits. GRA

N80-31559# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
MEASUREMENT OF THERMOPHYSICAL PROPERTIES OF EPOXY/DIAMINE POLYMERS AND ASSOCIATED ADDITIVE PROPERTIES
Gilbert F. Lee 11 Oct. 1979 37 p refs
(AD-A087833; NSWC/WOL/TR-78-195) Avail: NTIS HC A03/MF A01 CSCL 11/9

This report describes work done on several epoxy/diamine polymers. The goal of this work was to determine the coefficient of thermal expansion, specific heat capacity, and the structure to property relationship. Also the density, coefficient of thermal expansion, and heat capacity were predicted using the method of additive parameters. A comparison between the experimental and predicted properties was made to determine the accuracy of this method. GRA

N80-31560# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Div.
CERAMICS FOR VENICULAR ENGINES: STATE-OF-THE-ART Final Report
R. Nathan Katz Jun. 1980 25 p refs Presented at the 4th Conf. on Mod. Ceram. Technol., St. Vincent, Italy, 28-31 May 1979
(DARPA Order 1849)
(AD-A087589; AMMRC-MS-80-2) Avail: NTIS HC A02/MF A01 CSCL 11/2

The use of silicon-based, high performance ceramics offers significant potential for energy conservation in heat engine technology. In particular, three families of silicon-based engineering ceramics, the alumino silicates, the silicon nitrides, and the silicon carbides, possess unique combinations of properties which make these materials very attractive candidates for components in gas turbine, diesel, and Stirling engines. After a brief discussion of the design process with brittle materials, this paper will review some of the relevant properties of various members of each of these three families of engineering materials, as processed by a variety of routes. Some advantages and disadvantages of the major materials/process combinations will be discussed. Selected examples of applications of a variety of materials/process combinations as applied to vehicular engine technology will be presented. GRA

N80-31561# Rensselaer Polytechnic Inst., Troy, N. Y.
MELT RHEOLOGY OF BLOCK COPOLYMERS IN RELATION TO MELT STRUCTURE Final Report, 24 Sep. 1976 - 23 Mar. 1980
C. I. Chung 23 Jun. 1980 33 p refs
(Grants DAAG29-76-G-0334; DAAG29-78-G-0178)
(AD-A087484; CIC-ARO-80-1; ARO-14149.3-MS) Avail: NTIS HC A03/MF A01 CSCL 11/9

It is well known that block copolymers composed of incompatible polymers have multiphase structure, each component polymer being separated into its own phase, and their multiphase structure leads to unusual physical properties. In particular, block copolymers composed of a soft polymer as the major component and a hard polymer as the minor component can have elastomeric properties since the hard polymer blocks from different molecules segregate into hard domains dispersed in the soft matrix of the soft polymer blocks and the hard domains serve as crosslinking and reinforcement. Some block copolymers of this nature are now successfully used as thermoplastic elastomers. Block copolymers also exhibit unusual melt rheological properties notably very high viscosity and elasticity in comparison to the component homopolymers of equal molecular weight. The unusual melt rheological properties have been attributed to the remnants of the multiphase structure which persist far above the glass transition or melting points of the component polymers. GRA

N80-31562# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
ANALYSIS OF FLUORIDE IN POLYMER MATERIALS
Benny R. Richardson May 1980 12 p refs
(Contract DE-AC04-76DP-00487)
(MHSMP-80-23) Avail: NTIS HC A02/MF A01

In order to determine whether bis (2,2-dinitro-2-fluorethyl) formal is present in polymers, a fluoride-specific ion electrode was tested. Interference was eliminated by means of matrix matching. The method was calibrated. DOE

N80-31563# California Univ., Livermore. Lawrence Livermore Lab.
ANALYTICAL TESTING AND CHARACTERIZATION OF THREE POLYSILOXANE GUMS
J. R. Kolb, W. E. Cady, E. S. Jessop, and D. M. Hoffman 28 Apr. 1980 19 p refs Presented at the JOWOG Meeting, Kansas City, Mo., 16-18 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-84351; CONF-800628-1) Avail: NTIS HC A02/MF A01

The development of characterization methodology for silicone gums as well as the concomitant chemical and physical analyses of the polysiloxanes RG97, SE54 and Y3976 are discussed. Procedures for the determination of anti M/sub w/, anti M/sub n/, and MWD vinyl and phenyl contents of the gums by magnetic resonance or chromatographic techniques, and volatile content of the gums by thermogravimetric analysis are briefly addressed. A comparison of the siloxane gums indicates that the random SE54 is a high phenyl content, high molecular weight, low volatile resin of high quality. RG97 is in contrast a relatively low molecular weight, high volatile content gum that is inferior to SE54. The developmental material Y3976, which is synthesized by a different procedure, is close in properties to the SE54 gum but is somewhat lower in phenyl content. DOE

N80-31564# California Univ., Livermore. Lawrence Livermore Lab.
SYNTHESIS OF BLOCK COPOLYMERS OF METHYL SILOXANE, PHENYL SILOXANE, VINYL SILOXANE, ETCETERA Summary Report, 1 Aug. 1978 - 30 Jun. 1979
J. A. Ibemsei 30 Jun. 1979 7 p refs
(Contract W-7405-eng-48)
(UCRL-15159) Avail: NTIS HC A02/MF A01

Synthesis of homo poly(dimethylsiloxane) PDMS, homo poly(diphenylsiloxane PDPS, and di and tri block copolymers of PDMS and PDPS were carried out by anionic living polymerization, using the following reagents: hexamethylcyclotrisiloxane, HMTS and hexaphenylcyclotrisiloxane, HPTS (monomers), n-BuLi and dilithium diphenyldisilanolate, DLS (initiators), DMSO and THF (promotors) and Toluene (solvent). Lithium based catalysts were used in order to minimize siloxane rearrangement (equilibration) reactions. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-31565 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE 16TH JANNAF COMBUSTION MEETING, VOLUME 1
Thomas W. Christian, ed. Dec. 1979 744 p refs Meeting held in Monterey, Calif., 10-14 Sep. 1979 4 Vol.
(Contract N00024-78-C-5384)

(AD-A084680; AD-E500148; CPIA-Publ-308-Vol-1) Avail: Issuing Activity CSCL 21/9

Topics on deflagration-to-detonation transition (DDT) and on combustion within guns are presented. Subjects discussed include: impact DDT and sympathetic detonation; DDT of granulated propellants; stress, fracture, and ignition processes involved in DDT; screening tests for DDT; liquid propellant gun technology; charge design and gun propellant combustion; gun ignition processes and mechanisms; and gun modeling and performance. For individual titles, see N80-31566 through N80-31587.

N80-31566 Los Alamos Scientific Lab., N. Mex.
PRIMER ON SDT, XDT, PICKUP, AND SYMPATHETIC DETONATION
Louis C. Smith and Bobby G. Craig *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 1-13 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The chain of events underlying accidental detonation is discussed, beginning with charge breakup and/or ignition. Deflagration, shock formation, and then shock detonation transition (SDT) all constitute the deflagration detonation transition (DDT) phase. Detonation waves, defined as intense, reactive shock waves, are analyzed as well as other less reactive types of shock waves. The chain of events for sympathetic detonation, XDT, and pickup are also presented. E.D.K.

N80-31567 Los Alamos Scientific Lab., N. Mex.
USE OF FLASH X-RAY AS A DIAGNOSTIC TOOL IN THE DYNAMIC TESTING OF PROPELLANTS AND ROCKET MOTORS
L. E. Bryant and J. A. Bertola (Hercules, Inc., Magna, Utah) *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 15-26 (For primary document see N80-31565 22-28)
(Contract N00030-78-MO-78007)
Avail: Issuing Activity CSCL 21/9

A brief introduction to the technique of flash X-ray is given. Flash X-ray applications at 150 kV, 480 kV, and 2 MeV are explained as to purpose of tests and flash X-ray diagnostics. The parameters of these tests are given as are pictures of the X-ray results with explanations of the images and the conclusions drawn from them. Author

N80-31568 Hercules, Inc., Magna, Utah.
PROPELLANT EXPLOSIVE REACTIONS IN THE INSTRUMENTED SHOTGUN TEST
R. C. Jensen *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 27-41 ref (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Instrumented shotgun tests were conducted on crosslinked double base propellant over an impact velocity range from 0.152 to 0.914 mm microsecond. Four different types of reactions were observed. Reactions were classified based on flash X-ray photographs, blast overpressure, light intensity, and target plate damage. No sharp velocity threshold exists between the various reaction regimes. Reactions at impingement velocities less than those required to produce high order detonation are of great interest. Author

N80-31569 Hercules, Inc., Magna, Utah.
A SCALING RELATIONSHIP FOR IMPACT INITIATED DETONATIONS
B. Brown, L. Green (California Univ., Lawrence Livermore Lab.), R. Hunt (Hercules, Inc., Cumberland, Md.), and R. W. Courtney (Hercules, Inc., Cumberland, Md.) *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 43-50 refs (For primary document see N80-31565 22-28)
(Contract N00030-74-C-0100)
Avail: Issuing Activity CSCL 21/9

The results of experiments on one solid propellant are combined with other similar data to yield a scaling correlation for impact initiation of detonation. A modification of the critical energy concept is used to correlate the data. The solid propellant thus considered is less impact sensitive than either TNT or PBX-9404 in impact tests. Author

N80-31570 Naval Surface Weapons Center, White Oak, Md.
BURNING TO DETONATION TRANSITION IN POROUS BEDS OF A HIGH ENERGY PROPELLANT
R. R. Bernecker, D. Price, and H. W. Sandusky *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 51-78 refs (For primary document see N80-31565 22-28)
(Contract N00030-78-WR-82428)
Avail: Issuing Activity CSCL 21/9

In the high confinement apparatus it was demonstrated that pressurization along most of the predetonation column was mild. The region of accelerating pressure buildup, necessary for DDT, occurred shortly before a transition to detonation. This pressure buildup was associated with the propagation of compressive waves both forward and rearward in the predetonation period. The origin of the event producing these compressive waves appears to be a rapid heat release mechanism rather than a pressure buildup produced by confined burning. The predetonation column lengths observed in the high and low confinement systems are comparable at high porosities. Thus, the effect of confinement on the DDT susceptibility of this material at high porosities is small although confinement would be expected to be more important at lower porosities. E.D.K.

N80-31571 Naval Surface Weapons Center, White Oak, Md.
DEFLAGRATION TO DETONATION TRANSITION BEHAVIOR OF ALUMINIZED HMX
Donna Price and A. R. Clairmont, Jr. *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 79-89 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The effect of fine and coarse aluminum on the transitional behavior of HMX in charges pressed to 90% theoretical minimum density was investigated. A thick walled tube with heavy end closures is instrumented with ionization probes (IP) and strain gages (SG). These serve to measure front velocities, convective ignition and detonation fronts from the IP data, and compressive fronts from the SG data. Other parameters measured were predetonation column length and two relative times to detonation, the time of discharge of the first ionization probe to time of onset of detonation and the time between the appearances of the first compressive front and onset of detonation. It was found that the aluminized charges which exhibited transition appeared to follow the same DDT mechanism as that initially proposed for 91/9 RDX/wax and that shown by pure RDX and pure HMX. Although the presence of aluminum did not change the DDT mechanism, it did slow down the transitional process increasingly as the Al content rose. All three DDT parameters show a smooth increase with increasing aluminum content. E.D.K.

N80-31572 Naval Surface Weapons Center, White Oak, Md.
COMPACTION AND THE BURNING TO DETONATION TRANSITION AT LOW CONFINEMENT
R. R. Bernecker, H. W. Sandusky, and A. R. Clairmont, Jr. *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 91-116 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

A study was made of the deflagration to detonation transition (DDT) in porous charges of propellants at low confinement using a streak camera and flash radiography. To measure density gradients quantitatively along the porous column, X-ray tracers were added to the porous columns during pressing. The propellants evaluated in this work included two friable, crosslinked double base (XLDB) propellants, VLU and VLZ, a modified double base propellant, FKM, and a nitrocellulose (NC) ball powder. The FKM and NC were in a powdered form, the VLZ was shredded and the VLU particles were cuboid. At about 56% theoretical maximum density shredded VLZ and granular FKM transited to detonation while the NC did not. The NC material showed extensive axial compaction although the density profiles along the column were the lowest of all the materials. The VLZ exhibited both axial and radial compaction which was distinctly unsymmetrical, the radiographs illustrated severe nonplanar displacement of the tracers. E.D.K.

N80-31573 Naval Surface Weapons Center, White Oak, Md.
EFFECT OF PROPELLANT CRACK BURNING ON HIGH ENERGY PROPELLANT SAFETY

K. Kim *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 121-141 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Selective calculations were made for burning in cracks as it pertains to solid rocket motor propellants. The possibility of obtaining pressures high enough to cause a shock to detonation transition (SDT) in propellant grains is examined. Variables effecting the crack combustion process selected for study are: crack shape, location, surface roughness, propellant deformation, ignition criterion, and burning rate. Results suggest that SDT should not occur in propellants unless the granulation of the grain is severe enough to provide large burning surface area.
Author

N80-31574 Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MODEL FOR CONFINED COMBUSTION OF COMPRESSIBLE, LINEAR VISCOELASTIC SOLID PROPELLANT
Douglas E. Kooker *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 143-165 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

A mathematical model is developed for transient combustion of an end burning, compressible, linear viscoelastic solid propellant grain confined in a one dimensional closed chamber. The time dependent analysis is capable of studying nonlinear wave propagation in both the solid and gas phases. Theoretical predictions for a family of fast burning propellants indicate (1) pulsating burning rates as well as stress waves in the propellant, (2) traveling waves in the gas phase which grow to shock strength, and (3) a burning rate excursion in which the gas velocity leaving the surface approaches the sonic condition.
Author

N80-31575 Utah Univ., Salt Lake City. Dept. of Mechanical and Industrial Engineering.
A CALCULATIONAL MODEL FOR FRAGMENTATION IN VISCOELASTIC MATERIALS
S. R. Swanson *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 167-176 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Experimental evidence has shown that under certain combinations of stress loading and material properties, fracture in solids can occur in which a large number of particles are formed. A model of fracture for viscoelastic materials is presented that attempts to calculate the distribution of fragment size and the associated surface to volume ratio of these fragments. Calculations are made on an element basis in conjunction with a dynamic finite element code. The model assumes a statistical distribution of inherent microflaws that grow under stress according to quasistatic and dynamic crack propagation laws measured in laboratory tests. Crack interaction to form fragments is computed on a statistical basis. Calculations for a shear test geometry show formation of few fragments at low test speeds, but a significant increase in surface to volume ratios at higher velocities. These results are in good agreement with laboratory test results.
E.D.K.

N80-31576 Los Alamos Scientific Lab., N. Mex.
SHEAR IGNITION OF EXPLOSIVES
A. W. Campbell *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 177-198 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The role of shear in the initiation of burning in explosives was explored. The PBX-9404, a rigid explosive containing 96 wt% HMX, and a compliant propellant containing 50 wt% solids were subjected to pressure pulses of a few kilobars amplitude. Pressure pulses were generated by burning HMX at loading densities from 0.04 to 1.22 g/cu cm and were transmitted to the test explosive usually by a metal piston. It was shown that violet burning can be induced in the PBX-9404 by rapid compression, and by the use of steel shear rings the rate of reaction can be intensified so that a transition from burning to detonation results.
R.C.T.

N80-31577 Naval Weapons Center, China Lake, Calif.
COOK-OFF IN FUEL FIRE
Ronald F. Vetter *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 199-204 (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Solid rocket motors reaction to immersion in fuel fire is considered. The complexity of the thermal and structural occurrences leading to eventual pressure vessel failure are discussed. An attempt is made to understand and predict the mode of failure (level of violence of the reaction) with computer modeling as well as actual fire tests of various configurations.
R.C.T.

N80-31578 Naval Surface Weapons Center, White Oak, Md.
DETECTION OF LOCAL HEATING AND REACTION INDUCED BY IMPACT
C. S. Coffey, W. L. Elban, and S. J. Jacobs *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 205-219 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

A heat sensitive film was used to detect the heat generated in a sample by impact. Localized hot spots were recorded in inert, explosive and propellant materials. In the explosives and propellants these hot spots were potential ignition sites. It was demonstrated that the physical properties of the sample have a profound influence on the amount of local heating generated by impact.
R.C.T.

N80-31579 Sandia Labs., Albuquerque, N. Mex.
INITIATION OF GRANULAR EXPLOSIVES BY RAMP WAVES
R. E. Setchell *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 221-231 refs (For primary document see N80-31565 22-28)
(Contract DE-AC04-76DP-00789)
Avail: Issuing Activity CSCL 21/9

Initiation processes in granular explosives experiencing finite risetime loading, in contrast to shock loading were investigated. Ramp waves having a risetime of either 0.3 micro seconds or 0.8 micro seconds were transmitted into the explosive PBX-9404, resulting in initial waves having a peak axial stress of 5.1 GPa. The incident waves were generated in discs of a glass-ceramic, pyroceram, by planar impact of copper faced projectiles using a gas fired gun facility. Velocity interferometry was used to measure particle velocity histories after the initial wave had propagated through explosive samples having different thicknesses. For comparison, similar measurements were made for the case of shock loading to the same initial peak stress.
R.C.T.

N80-31580 Hercules, Inc., Magna, Utah.
TRANSITION TO DETONATION OF CROSSLINKED DOUBLE-BASE PROPELLANT IN LARGE SCALE NOL CARD GAP TESTS
Robert L. Keefe *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 233-245 (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The susceptibility of explosives and propellants to the shock initiation of detonation was determined. The effects of variables on rocket motor hazards were analyzed. Operational techniques and materials, sample preparation, sample formulation variation, and sample processing variations were tested.
R.C.T.

N80-31581 Princeton Combustion Research Labs., Inc., N.J.
COMPRESSION-IGNITION SENSITIVITY STUDIES OF LIQUID MONOPROPELLANT IN A DYNAMIC-LOADING ENVIRONMENT
N. A. Messina, L. S. Ingram, P. E. Camp, and M. Summerfield *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 247-284 refs (For primary document see N80-31565 22-28)
(Contract DAAK10-78-C-0315)
Avail: Issuing Activity CSCL 21/9

Monopropellant liquid propellant gun systems were developed generally along two lines, the preloaded type (so-called bulk loaded liquid propellant gun and the direct injection type (so-called regenerative type). In each of these types, the liquid

charge was brought rather rapidly up to gun operating pressure, ca. 30 to 60 kpsi, in a rise time on the order of 0.1 to 1 msec. Although hundreds of successful firings were made with both types of gun, with several different types of liquid monopropellant, in sizes up to 4 inch barrels, a few destructive explosions have taken place, all of them on startup during the rapid pressure rise associated with ignition of the gun. This almost successful test record suggests that the particular monopropellants selected are not themselves at fault, or explosions would have occurred with far greater frequency. R.C.T.

N80-31582 Ballistic Research Labs., Aberdeen Proving Ground, Md.

TRANSIENT COMBUSTION CALCULATIONS WITH VARIABLE THERMAL PROPERTIES

Carl W. Nelson *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 327-337 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

The response of solid propellant combustion to steep pressurization pulses was calculated with consideration of temperature dependent thermal properties of the solid and quasisteady gas phase. Response was calculated for a uniformly distributed gas phase reaction and for the Zeldovich heat feedback theory with variations in surface heat release, pressurization rate, and thermal properties of the solid. Regression rate excursions of two to three times the quasi-steady rate ($r = aP^n$) were calculated for nominal values of propellant properties. Higher excursions were calculated for the distributed flame with assumed constant thermal properties. For pressurization rates approximating calculated DDT rates, the excursions survived at high pressures. R.C.T.

N80-31583 Ballistic Research Labs., Aberdeen Proving Ground, Md.

COMBUSTION CHARACTERISTICS OF CONSOLIDATED PROPELLANTS

A. A. Juhasz, I. W. May, W. P. Aungst, J. O. Doali, and R. E. Bowman *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 433-452 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

Consolidated single and double base extruded propellants and a double base ball propellant were burned in a closed bomb. The parameters studied included mode of ignition and effects of compaction density on sample combustion. Overall mass burning behavior, especially round to round reproducibility, was found to be strongly ignition dependent. Consolidation was found to reduce the average mass generation rate for the propellant samples. Surface area ratio vs. mass fraction burned plots were generated for these runs using an inverse closed bomb data reduction program. Progressive surface area development was observed for fifty percent or more of propellant mass fraction burned. Best progressivity was found for the most dense, physically strongest propellant samples. Author

N80-31584 Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

IGNITION OF SOLID PROPELLANTS UNDER TRANSIENT FLOW CONDITIONS

Avi Birk and Leonard H. Caveny *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 515-540 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

The site and mode of convective ignition of propellant cylinders in crossflow was determined. A shock tunnel was used to provide up to 20 ms of flowing heated gas at: 1 to 2 MPa; 1600 to 2100 K; 10 to 300 m/s. Test gases were 100% N2, 10% O2/90% N2, and 50% O2/50% N2. Instrumentation included six radiation detectors, high speed shadowgraph sequences, pressure probes, and heat flux gauges. Ignition is a gas phase process. Compared to triple base propellant, single base and double base propellants ignited more rapidly in oxidizer containing flows. Flame blowoff occured for high Reynolds number (e.g., 16,000), low free stream oxidizer flows. The high heating rates accompanying boundary layer development can produce submillisecond ignition. Depending on the flow conditions first ignition occurs either at the leading edge or in the wake. R.C.T.

N80-31585 Ballistic Research Labs., Aberdeen Proving Ground, Md.

SHOCK TUBE IGNITION OF NITROCELLULOSE AND NITRAMINES

Arthur Cottien and Leon J. Decker *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 541-546 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

A reflected shock technique was used to study ignition of small (approximately 1 micrometer particles of NC (12.2% N), RDX and HMX by shock heated N2 at reflected shock gas temperatures (T bar) between 600-1200 K and pressures between .1-1.5 MPa. For T bar > 750 K, ignition delays were independent of pressure and were almost independent of T bar. For T < 750 K, the temperature dependence increased markedly and the nitramine delays showed an inverse pressure dependence although the NC delays remain pressure independent. The activation energy for the delays was approximately 37 Kcal/mole for HMX and 17 Kcal/mole for NC. R.C.T.

N80-31586 Army Armament Research and Development Command, Dover, N. J.

HOLOGRAPHIC OBSERVATIONS OF BLACK POWDER COMBUSTION

R. Field, P. Wartman, and J. D. Trolinger (Spectron Development Labs., Inc., Costa Mesa, Calif.) *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 547-558 refs (For primary document see N80-31565 22-28)

(Contract DAAK10-79-M-4364)

Avail: Issuing Activity CSCL 21/9

The basic combustion behavior of black powder and other igniter materials using pulsed laser holography was investigated. The combustion of single grains of black powder was examined at ambient pressure and pressures up to 0.72 MPa (105 psi). The short pulse duration and monochromaticity of the laser radiation provided high spatial resolution in the recording of the particle field generated during the grain combustion. Particle velocities obtained from double pulsed holograms were examined. The formation of the observed particle field appears to be due in part to stripping-off of a molten reactant material from the surface of the grain by gases forming within a molten surface layer. Differences in the particle field with change in pressure were also studied. R.C.T.

N80-31587 Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

MEASUREMENT AND CORRELATION OF INTRAGRANULAR STRESS AND PARTICLE-WALL FRICTION IN GRANULAR PROPELLANT BEDS

K. K. Kuo, B. B. Moore, and V. Yang *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 559-581 refs (For primary document see N80-31565 22-28)

(Contract DAAG29-77-G-0163)

Avail: Issuing Activity CSCL 21/9

A test rig was designed for obtaining instantaneous porosity, intragranular stress, and particle wall friction in the mechanical compaction of granular material. A dimensionless compaction similarity parameter was found to correlate the experimental data well, regardless of particle size and shape. Empirical correlations for WC-870 and WC-846 granular propellants were obtained. Mathematical expressions for the speed of sound transmitted through these two types of propellants were also obtained. A scanning electron microscope was used to examine some of the deformed granular propellants after compaction. Numerous surface fissures were observed; these increased surface areas may contribute significantly to the DDT process. R.C.T.

N80-31588 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.

THE 16TH JANNAF COMBUSTION MEETING, VOLUME 2

Thomas W. Christian, ed. Dec. 1979 666 p refs Conf. held at Naval Postgraduate School, Monterey, Calif., 10-14 Sep. 1979

(Contract N00024-78-C-5384)

(AD-A084681; CPIA-Publ-308-Vol-2) Avail: Issuing Activity CSCL 21/9

Various aspects of propellant combustion are discused. Among the topics considered are: nitramine decomposition and combustion; steady state combustion; aluminum combustion; and

combustion instrumentation and diagnostics. For individual titles, see N80-31589 through N80-31623.

N80-31589 Ballistic Research Labs., Aberdeen Proving Ground, Md.
A PRIORI THERMOCHEMISTRY AND RATE CONSTANT ESTIMATES FOR FLAME ZONE REACTIONS
G. F. Adams and G. D. Bent *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 113-125 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

The use of theoretical chemical methods to predict the properties and chemical rate coefficients for several evanescent chemical species that occur in propellant flames is described. Molecular electronic structure theory calculations were used to predict heats of reaction and activation barriers with estimated error of plus or minus 2 kcal per mol. R.C.T.

N80-31590 Georgia Inst. of Tech., Atlanta.
COMBUSTION OF NON-ALUMINIZED BINDERS IN TAPERED SANDWICHES
J. C. Handley, E. W. Price, and A. Ghosh *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 127-147 refs (For primary document see N80-31588 22-28)
(Contract N00014-75-C-0332)
Avail: Issuing Activity CSCL 21/9

Four different binders in a tapered two dimensional ammonium perchlorate (AP)-binder sandwich were investigated. Both quenched combustion techniques and cinephotomacrography of the burning samples were used to observe the deflagration process and the interaction of the diffusion flamelets with it. The four binders were tested over the 1.38 MPa (200 psi) to 13.8 MPa (2000 psi) pressure range. The scanning electron microscope was used to investigate the partially burned samples. Particular emphasis was placed on the binder layer and its residue along with the melt flow out over the oxidizer surface. It was found that a minimum binder thickness existed at 1.38 MPa beyond which deflagration could not be sustained. The binder melt flow was very important in determining the AP deflagration rate in the vicinity of the binder. R.C.T.

N80-31591 Dayton Univ., Ohio.
STATISTICAL ANALYSIS OF COMPOSITE SOLID PROPELLANT COMBUSTION
Robert L. Glick *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 149-152 refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-0022-79)
Avail: Issuing Activity CSCL 21/9

Functional forms for correlating steady state ballistic data were tested. Results indicate that these forms markedly improve correlation in certain cases but failed in precisely those cases where previous correlations were successful. R.C.T.

N80-31592 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
EFFECT OF EROSIVE BURNING ON PRESSURE AND TEMPERATURE SENSITIVITY
J. P. Renie, M. E. Barger, and J. R. Osborn *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 153-169 refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-3381-77)
Avail: Issuing Activity CSCL 21/9

The results of calculations of burning rate, pressure exponent and temperature sensitivity are presented for a series of monomodal ammonium perchlorate propellants. Both the oxidizer particle size and the crossflow velocity are considered as parameters. The results are obtained with the erosive burning petite ensemble model. This erosive burning model is based on the hypothesis that the erosive burning effect is due to the enhancement of the transport properties in the gas phase reaction zones caused by the presence of a turbulent boundary layer. Results indicate that burning rate, pressure exponent and temperature sensitivity may be materially changed as the cross flow velocity is increased for those propellants having an oxidizer particle size greater than a certain size. Below an oxidizer particle size of 10 microns, the results show that these combustion parameters remain unchanged as the crossflow velocity is increased. Above this oxidizer particle size, an increase in the crossflow velocity causes substantial increases in both the propellant burning rate and pressure exponent. At the same time, decreased temperature sensitivity results for increased crossflow velocities with propellants having the larger oxidizer particles. R.C.T.

N80-31593 Atlantic Research Corp., Alexandria, Va.
AN INVESTIGATION OF THE EFFECTS OF FORMULATION PARAMETERS ON EROSIVE BURNING OF COMPOSITE PROPELLANTS
Merrill K. King *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 171-191 refs (For primary document see N80-31588 22-28)
(Contract F49620-78-C-0016)
Avail: Issuing Activity CSCL 21/9

A series of ten composite solid propellants with systematically varied formation parameters were characterized with respect to the dependence of burning rate on pressure and product crossflow velocity over a wide range of these variables. Predictions of the erosive burning characteristics of these formulations made with a simple model based on columnar diffusion flame bending were found to agree fairly well with data except at low pressure conditions where propellant heterogeneity is relatively unimportant. A second generation, considerably more fundamental model of composite propellant combustion (with and without crossflow) which includes both the flame bending mechanism and a turbulent transport property augmentation erosive burning mechanism also yielded predictions in good agreement with data, even in the low pressure region where the first generation model failed for five of the six formulations against which it has been tested to date. The most important factor effecting the sensitivity of composite propellant burning rate to crossflow was found to be the base (no crossflow) burning rate versus pressure characteristics of the propellant, low burning rate propellants being more sensitive to crossflow. R.C.T.

N80-31594 Aeronautical Research Associates of Princeton, Inc., N. J.
ANALYSIS OF AMMONIUM PERCHLORATE COMBUSTION IN A TURBULENT FLOW
R. A. Beddini and A. K. Varma *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 193-210 refs (For primary document see N80-31588 22-28)
(Contract F49620-78-C-0016)
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The effects of turbulence on the mean reaction rate and on reaction rate correlations (combustion-turbulence interaction) was investigated with application to the erosive burning of ammonium perchlorate (AP). The analysis indicates that regions of both decreased and increased reaction rate and turbulent diffusivity can exist in the flame zone, and that the decreased reaction rate may account for the decreased burning rate (negative erosion) observed for some propellants. Fully interacting calculations were performed using a previously developed erosive burning theory and both the Beckstead-Derr-Price (BDP) and Guirao-Williams AP combustion models. The results show that: (1) although significant changes in reaction rate and turbulent diffusivity profiles are obtained, no appreciably decreased burning rate is predicted for AP using either combustion model; (2) for both normal and erosive burning, the flame height produced by the BDP model is substantially greater than that produced by the Guirao-Williams model; and (3) as a consequence of the disparate flame heights, a much greater susceptibility of AP to erosive burning is predicted with the BDP model. R.C.T.

N80-31595 Air Force Systems Command, Wright-Patterson AFB, Ohio.
EROSIVE BURNING, A SURVEY OF THE RUSSIAN LITERATURE
Wayne A. Zwart and Robert L. Glick *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 211-224 refs Prepared in cooperation with Dayton Univ., Ohio (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

A survey of Russian literature in the area of erosive burning is presented with specific emphasis on erosive burning. It is shown that the Soviets have established that negative erosion

exists as a result of eddy currents. It is demonstrated that when the propellant is released form the surface in the condensed phase, positive erosion can be eliminated when specific conditions exist. Dynamic erosion has also been investigated and the effects of velocity and frequency were established. R.C.T.

N80-31596 Naval Weapons Center, China Lake, Calif. Aerothermochemistry Div.
EFFECT OF BINDER TYPE ON ALUMINUM COMBUSTION AND ALUMINUM OXIDE FORMATION
K. J. Kraeutle, R. Reed, Jr., A. I. Atwood, and H. B. Mathes *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 225-236 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

The combustion of three aluminized propellants which contained different binders was studied in a window bomb, a pipe burner, and a T-burner. The binders were chosen for their particular decomposition behavior and for their interaction with ammonium perchlorate (AP) as observed by hot-stage microscopy. The results show the influence of binder type on the burn rate, on the size distribution of residue collected after pipe burner and T-burner firings, and on the acoustic damping as measured in the T-burner at a frequency of 800 Hz. Damping rates of the propellants were calculated based on the size data of T-burner as well as pipe burner residues for comparison with measured values. Finally, the combustion of the propellants and the decomposition of their binders were observed by cinephotography. Author

N80-31597 Naval Research Lab., Washington, D. C.
APPLICATION OF ADVANCED OPTICAL SPECTROSCOPIC METHODS TO ENERGETIC MATERIALS
L. S. Goldberg, J. M. Schnur, P. E. Schoen, W. L. Faust, T. R. Royt, S. Wunder, and M. Abebe *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 237-243 refs Sponsored in part by ONR and Naval Sea Systems Command (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

Progress on the application of advanced optical spectroscopic methods to the study of energetic materials is described. Principal areas of research are high pressure Brillouin and Raman light scattering spectroscopy and picosecond laser spectroscopy. E.D.K.

N80-31598 Los Alamos Scientific Lab., N. Mex.
TEMPORAL AND SPATIAL LOCATION OF THE TRANSITION-TO-DETONATION POINT IN PROPELLANT GRAINS
A. S. Lundy, J. B. Ramsay, A. L. Criscuolo, A. D. Martin, J. A. Montoya, and J. R. Parker *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 245-255 Sponsored in part by SAMSO, AFRPL and US Navy Strategic Systems Project Office (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

Techniques used for the study of the high speed phenomena associated with condensed phase explosives and which are modified and applied to the diagnosis of detonation transition in several test motors are reviewed. The general design criteria for such instrumentation with regard to the frequency response of the transducer, signal channels, and recording equipment are reviewed as well. E.D.K.

N80-31599 Aerojet Solid Propulsion Co., Sacramento, Calif.
TESTING OF A UNIQUE IGNITION SYSTEM FOR LARGE SOLID-PROPELLANT ROCKET MOTORS
D. L. Nachbar and M. B. McDole *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 257-271 refs (For primary document see N80-31588 22-28)
(Contract F04701-73-C-0423)
Avail: Issuing Activity CSCL 21/9

The design, analyses, and test results of an integral caseless, nozzleless ignition concept for large solid propellant rocket motors is presented. An approximate 60 percent rocket motor igniter inert weight reduction for payload trade-off gain was the primary ignition concept advantage. The ignition system main charge is formed by configured motor propellant at the forward section of the motor around the igniter boss. This configured forward section, which is an integral portion of the motor propellant grain, is designed to operate as a small, low pressure nozzleless rocket motor, providing sufficient pressure and heat-flux output into the main motor propellant section to achieve reproducible motor ignition. Forward section propellant ignition is achieved by output from a relatively small, radial exhausting pyrotechnic igniter containing BKNO3 pellets. The integral caseless, nozzleless igniter concept was successfully demonstrated, and ignition concept performance and motor propellant ignition performance met design requirements. Also target weight requirements for the MX Upper Stage motor were achieved. However, potential problems in motor grain stress were encountered. M.G.

N80-31600* Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
THEORETICAL DETERMINATION OF NOZZLE ADMITTANCES USING A FINITE ELEMENT METHOD
R. K. Sigman and B. T. Zinn *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 273-286 refs (For primary document see N80-31588 22-28)
(Grant NsG-3036)
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A finite element method (FEM) is used to predict the admittances of axisymmetric nozzles. The flow in the nozzle is assumed to be isentropic and the disturbances are assumed to be small so that linear analyses apply. An approximate two dimensional compressible flow model is used to describe the steady flow in the nozzle. The propagation of acoustic disturbances is governed by the complete linear acoustic wave equation. This partial differential wave equation is transformed to an integral equation using Galerkin's method and Green's theorem is applied so that the acoustic boundary conditions can be introduced through the boundary residuals. A two dimensional finite element method using linear triangular elements is used to solve the integral acoustic equation. A one dimensional FEM is used to solve the reduced nozzle acoustic equation developed by Crocco and the solution is used to verify the sufficiency of the boundary residual formation. It is shown that agreement between predicted values of the admittance and experimental data is quite good. M.G.

N80-31601 Naval Weapons Center, China Lake, Calif. Aerothermochemistry Div.
ASSESSMENT OF CHAMBER PRESSURE OSCILLATIONS IN THE SHUTTLE SRB
H. B. Mathes *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 287-304 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

A combustion stability analysis performed for three burn times of the shuttle solid propellant booster motor (SRB) is discussed. The results of the analysis indicated that SRB was exceptionally stable. Analysis of motor firing data shows that a low level pressure oscillation is present throughout burn. The observed oscillations, while somewhat erratic in regard to both amplitude and frequency, show a general pattern through burn that is similar for all motors investigated to date. Variations in maximum pressure amplitude and frequency occur between different motors at the same burn time. The variations between motors have been statistically treated to provide predictions of maximum pressure amplitude and maximum and minimum frequency of the first axial acoustic mode under several sets of specified conditions. The origin of the pressure oscillations, which have not exceeded 0.25 percent of the mean chamber pressure, is thought to be connected with coupling between turbulence or vortex shedding and acoustic wave motions in the motor. M.G.

N80-31602 United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
PRELIMINARY EXPERIMENTS ON ACOUSTIC OSCILLATIONS DRIVEN BY PERIODIC SHEDDING
R. Dunlap and R. S. Brown *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 305-319 refs (For primary document see N80-31588 22-28)
(Contract F04701-77-C-0060)
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The flow and geometry combinations which maximize acoustic oscillations under rocket motor type flow conditions are investigated. Nitrogen was injected into a chamber through a sonic choke and exhausted through a second choke at the other end.

Two restrictors were located at various axial positions along the chamber. At each location, the spacing of the two restrictors was varied and the effect on the acoustic pressure level was measured. Amplitude frequency spectra of the pressure were obtained to determine which modes were excited. In addition, hot wire anemometer measurements were made in the region between the restrictors for some flow conditions. Comparisons between the pressure and velocity spectra show increased acoustic pressure levels occur simultaneously with increased velocity oscillations. The data also show that increased acoustic pressure levels can be correlated with Strouhal Number and position of the restrictors relative to the acoustic mode shape. The results support the thesis that periodic shedding may be an important source of acoustic driving in solid rocket motors. M.G.

N80-31603 Dayton Univ., Ohio.
ON RESPONSE FUNCTIONS FOR COMPOSITE SOLID PROPELLANT
Robert L. Glick *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 321-324 refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-0022-79)
Avail: Issuing Activity CSCL 21/9

The use of results from combustion modeling to provide a physically reasonable framework for manipulating (correlation, interpolation, extrapolation) experimental data thereby permitting one to operate from a sparse data base is discussed. Several modeling frameworks are examined and suggestions are made concerning the case of composite propellants. M.G.

N80-31604 Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
EXPERIMENTAL DETERMINATION OF SOLID PROPELLANT ADMITTANCES BY THE IMPEDANCE TUBE METHOD
J. D. Baum, B. R. Daniel, and B. T. Zinn *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 325-341 refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-2571-73)
Avail: Issuing Activity CSCL 21/9

The application of the modified impedance tube technique in the measurement of the admittances and response functions of burning solid propellants is addressed. The relationship between the admittance of the burning solid propellant surface and the impedance tube wave structure is utilized to determine the admittance at the propellant surface. This is accomplished by measuring the resulting acoustic wave structure and relating it to the unknown admittance by utilizing the solutions of the impedance tube wave equation. Improvements in the data acquisition and data reduction procedures are discussed. It is shown that the real part of the admittance Y sub R remains constant during the steady state burn period while gas phase losses may vary significantly during the same time period. Reproducibility of the measured quantities is estatblished as well as the capability of this experimental technique to measure gas phase losses in the impedance tube simultaneously with the measurement of the burning solid propellant surface admittance. M.G.

N80-31605 Princeton Univ., N. J. Mechanical and Aerospace Engineering Dept.
DIRECT MEASUREMENTS OF ACOUSTIC ADMITTANCE USING LASER DOPPLER VELOCIMETRY
L. H. Caveny, K. L. Collins, and S. W. Cheng *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 343-361 refs Sponsored by ONR and Army Ballistic Research Lab. (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

Research was directed at making measurements of velocities in propane/air and solid propellant flames using laser Doppler velocimetry (LDV) instrumentation. Combustors were developed to impose a controlled periodic pressure disturbance on burning solid propellants and to excite a propane/air flame. A tracking system was developed to maintain the LDV control volume at a fixed position above the regressing propellant surface. The research demonstrated double base and composite propellants and for alumina seeded propane/air flames. The simultaneous velocity and pressure measurements were used to obtain acoustic admittances. Author

N80-31606 United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
ROTATING VALVE FOR VELOCITY COMBUSTION RESPONSE MEASUREMENTS
R. S. Brown, R. C. Waugh, and V. L. Kelly *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 363-384 refs (For primary document see N80-31588 22-28)
(Contract F49620-77-C-0048)
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The dual valve approach for measuring velocity coupled characteristics in greater detail is investigated. A mathematical analysis of the transient ballistics was developed. The solution of the transient mass, momentum, and energy equations incorporates both linear and nonlinear velocity coupling, as well as pressure coupling, particle damping, flow turning, and nozzle losses in the analysis. Parametric studies were made by using the nonlinear velocity coupling model. The results show the interaction of mean velocity magnitude, threshold velocity, and amplitude of the velocity oscillation on the predicted pressure oscillations. An experimental apparatus was constructed and its performance under controlled cold flow conditions was compared with predictions. Agreement between predicted and experimental behavior was demonstrated under pressure coupled conditions. In the velocity coupled mode, the cold flow tests showed that control of the phase angle between the two valves is important to ensure proper performance of the apparatus. E.D.K.

N80-31607 Thiokol Corp., Brigham City, Utah. Wasatch Div.
INVESTIGATION OF THREE VELOCITY COUPLED T-BURNER DESIGN
Steven L. Folkman and Kenneth J. Wanlass *In* APL The 16th Jannaf Combust. Meeting, Vol. 2 Dec. 1979 p 385-398 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

An experimental investigation was conducted to compare various techniques of measuring the linear velocity coupled response of a solid propellant. Three velocity coupled T-burner designs were investigated: (1) a center vented T-burner, (2) a second mode T-burner, and (3) a flared end T-burner. Two basic propellants were utilized in testing: an aluminized PBAN propellant and an aluminized HTPB propellant. The primary intent of the investigation was to compare the nominal values of velocity coupled response and their dispersions in the three configurations. The flared end T-burner design exhibited considerably less data scatter than the center vented design. The nominal values of velocity coupled response calculated from the center vent and the flared end design are very comparable. Harmonic content in the flared end T-burner was lower compared to the center vent design. The second model T-burner gave a large amount of data scatter and does not appear to be a promising design. E.D.K.

N80-31608 Thiokol Corp., Huntsville, Ala.
STUDIES OF MOTOR INSTABILITY PROBLEMS
R. O. Hessler *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 399-428 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

Each of the three motors discussed was predicted to be stable by comfortable margins in the lower longitudinal modes. Two of the motors exhibited spontaneous oscillations in the axial modes. Data analysis of these motors indicated that the longitudinal modes were indeed stable and that the oscillations were driven by vortexes caused by flow over discontinuities in the propellant geometry. In each motor when the grain discontinuity was removed the oscillations were eliminated. These studies led to statement of a steady state solution to the cavity wave equation. This solution predicts finite amplitude oscillations in stable motors in response to combustion, flow, or external oscillatory inputs. A method of predicting the frequency and strength of flow periodicities is also presented. A single motor from a third project responded to what was considered a small charge pulse with a rapid growth to large amplitudes and a mean pressure increase. Analysis of the data indicates that the response was appreciably different from the basis of linear theory. E.D.K.

N80-31609 Naval Postgraduate School, Monterey, Calif.
A PRIMITIVE VARIABLE COMPUTER MODEL FOR COMBUSTION WITHIN SOLID FUEL RAMJETS
C. A. Stevenson and D. W. Netzer *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 429-450 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

An adaptation of a primitive variable, finite difference computer program was accomplished in order to predict the reacting flow field in a solid fuel ramjet. The predictions of the primitive variable computer model are compared with an earlier computer model and empirical data. It was found that the newer model reasonably predicted the flow field and permitted calculations within the aft mixing chamber. E.D.K.

N80-31610 Atlantic Research Corp., Alexandria, Va.
L*-INSTABILITY IN DUCTED ROCKET FUEL GENERATORS
B. D. Goracke and M. K. King *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 451-480 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

Studies have shown that a fuel throttling capability enhances the performance of a ducted rocket, while necessitating fuel rich gas generator operation at low pressure. Two fuel rich formulations were tested at low pressure and observed to exhibit oscillations much lower in frequency than those commonly observed with conventional propellants. A model was postulated and the theory confirmed that the oscillations were L* in nature and satisfactorily predicted L* pressure boundaries and frequency. E.D.K.

N80-31611 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A PHOTON CORRELATION LASER VELOCIMETER FOR USE IN TURBULENT MIXING REGION MEASUREMENTS
G. D. Catalano, H. E. Wright, and A. Cerrulo *In* APL The 16th JANNAF Combust Meeting, Vol. 2 Dec. 1979 p 461-469 refs Prepared in cooperation with Air Force Inst. of Technology (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

A laser velocimeter using a photon correlation processing scheme was developed for use in obtaining reliable information in turbulent mixing regions. Quantities measured in this investigation include mean velocities and turbulent intensities. Measurements were made in a rectangular nozzle free jet flow both with the laser velocimeter and with a hot-wire anemometer. The Mach number at the exit plane of the nozzle was varied from 0.2 to 0.8. The laser velocimeter obtained mean velocity data was found to correspond quite closely to the information obtained by using the hot-wire. The turbulent intensities were found to be much more difficult to measure using the laser velocimeter. Author

N80-31612 Systems Research Labs., Inc., Dayton, Ohio.
EVALUATION OF CARS IN A PRACTICAL COMBUSTION ENVIRONMENT
G. L. Switzer, W. M. Roquemore, R. P. Bradley, P. W. Schreiber, and W. B. Roh *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 471-485 refs Prepared in cooperation with AFAPL and Air Force Inst. of Technology (For primary document see N80-31588 22-28)
(Contract F33615-77-C-2019; AF Proj. 2308)
Avail: Issuing Activity CSCL 21/9

Results of coherent anti-Stokes Raman scattering (CARS) measurements made in a bluff-body-stabilized flame with turbulent and recirculating flow characteristics similar to those in many practical combustion systems are presented. The CARS system design is based upon a single-mode, ruby laser, oscillator amplifier combination operating at a repetition rate of 1 Hz and a ruby pumped, near infrared, broad band, dye, laser. Three types of CARS measurements are presents: (1) single pulse 0-branch spectra of N2 captured with an optical multichannel analyzer (OMA); (2) single pulse N2 and O2 number densities obtained by wide band integration of all Q branch lines; and (3) N2 spectra obtained by stepping a monochromator while exciting the medium with a broad band Stokes beam. Temperatures are estimated by comparing scanned N2 spectra with computer generated spectra. Axial and radial profile measurements of temperature, O2 concentration, and N2 concentration are presented. The results of CARS radial temperature measurements at a single axial location are compared with corresponding thermocouple data. The OMA spectra suggest that it is feasible to obtain single pulse measurements of temperture, N2 concentration, and O2 concentration at any location in the bluff-body-stabilized flame. E.D.K.

N80-31613* United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF THE FEASIBILITY OF CARS MEASUREMENTS IN SCRAMJET COMBUSTION
J. A. Shirley, D. C. Eckbreth, and R. J. Hall *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 487-509 refs (For primary document see N80-31588 22-28)
(Contract NAS1-15491)
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Results are presented of analytical and experimental investigations to determine the feasibility of using coherent anti-Stokes Raman spectroscopy (CARS) to measure temperature and species concentrations in supersonic combustion experiments. Experimental CARS spectra of O2 and H2 in a laboratory flat H2 - air diffusion flame are presented. Temperatures deduced from both species generally agree with radiation corrected thermocouple measurements. Oxygen concentrations were determined from the shape of the experimental spectra. Measured H2 CARS signal magnitudes are in good agreement with analytical predictions based on H2 concentration profiles determined from spontaneous Raman scattering. Based on these results, CARS diagnostics appear to be feasible if problems associated with the supersonic flow are not too severe. Author

N80-31614 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
COMPARISON OF THERMOCOUPLE, GAS SAMPLING, AND RAMAN MEASURED TEMPERATURES IN AN AFTERBURNING TURBOJET ENGINE PLUME
W. M. Roquemore and P. P. Yancy *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 511-527 refs Prepared in cooperation with Dayton Univ. Research Inst. (For primary document see N80-31588 22-28)
(Contract F33615-77-C-2019; AF Proj. 3048)
Avail: Issuing Activity CSCL 21/9

The results of plume temperature measurements made with three different probes, a Pt 13% Rh-Pt thermocouple probe, a gas sampling probe, and a spontaneous Raman scattering optical probe are desribed. Thermocouple measurements were corrected for radiation and recovery. A combination gas sampling and pressure probe was used to measure carbon dioxide, carbon monoxide, and total hydrocarbon concentrations and total gas stream pressures. Temperatures were calculated from the concentration measurements. Raman scattering measurements were made in a near-backscattering geometry using a pulsed nitrogen gas laser, a computer controlled SPEX double spectrometer, and an 8850 RCA photomultiplier tube with EGG/ORTEC time gated current integration detection apparatus. Raman temperatures were determined by fitting calculated spectra to the experimental spectra of the nitrogen gas in the plume. The temperatures measured by the Raman, gas-sampling, and thermocouple techniques were in agreement within the experimental error of about 5 percent except at maximum engine power where the thermocouple deviated by about 10 percent. E.D.K.

N80-31615 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
FLOWFIELD STUDIES OF DUMP COMBUSTERS
R. S. Boray *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 529-540 refs (For primary document see N80-31588 22-28)
(Contract F33615-78-C-2066)
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A comprehensive series of cold flow experiments was performed as part of a parametric study of the flow characterization of an axisymmetric dump combustor. Two inlets, one smaller than the other, were used. Gas concentrations of simulated fuel-air were measured in the dump combustor using an on-line mass

spectrometer. Gas sampling results with the smaller inlet showed better mixing compared to the larger inlets. In addition to gas sampling, measurements of total pressure profiles and wall static pressure were also obtained. The results of this effort are summarized. E.D.K.

N80-31616 Virginia Polytechnic Inst. and State Univ., Blacksburg. Aerospace and Ocean Engineering Dept.

MEAN DROPLET DIAMETER RESULTING FROM ATOMIZATION OF A TRANSVERSE LIQUID JET IN A SUPERSONIC AIR STREAM

J. A. Schetz, A. S. Nejad, and A. K. Jakubowski *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 541-555 refs Sponsored by AFOSR (For primary document see N80-31588 22-28)

Avail: Issuing Activity CSCL 21/9

The feasibility of routine measurements of the mean droplet diameter in the spray resulting from normal injection of liquid jets into a supersonic airstream under density conditions in a blow-down wind tunnel employing the diffractively scattered light technique was investigated. Studies of the effects of injector diameter, jet/free stream dynamic pressure ratios, and location in the jet plume on the mean droplet diameter were conducted. The diffractively scattered light technique is capable of measuring the mean droplet diameter in the spray with good experimental accuracy if great care is exercised in the selection and use of all optical components. The mean droplet size is on the order of 10 microns for injectors of the order of 1.3 mm. The mean droplet diameter has an inverse relation with respect to jet/free stream dynamic pressure ratio, a direct relation with the orifice diameter and decreases as the measurement station moves farther downstream from injector orifice and the smallest droplets are always found near the windward edge of the spray plume. E.D.K.

N80-31617 University of Southern California, Los Angeles. Combustion Lab.

REDUCTION OF COMBUSTION EFFICIENCY ASSOCIATED WITH LIQUID PHASE DROP DECOMPOSITION

M. Gerstein and P. Roy Choudhury *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 557-568 ref (For primary document see N80-31588 22-28)
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The inefficiency of droplet evaporation due to liquid phase pyrolysis at higher pressures results in a nonlinear form of diameter squared relationship. Under such a condition, a coupling between evaporation and liquid phase pyrolysis can cause a large reduction in the combustion efficiency of an advanced airbreathing propulsion system using either a commercial fuel blend or a synthetic fuel. The degradation in combustion efficiency can be minimized by accelerating the initial evaporation process before significant pyrolysis can take place and the concentration of the residue can increase. E.D.K.

N80-31618 General Electric Co., Lynn, Mass. Aircraft Engine Group.

HIGH DENSITY FUELS DESIGN CONSIDERATIONS FOR COMBUSTORS AND COMBUSTION ASSESSORIES IN SUBSONIC CRUISE MISSILE PROPULSION SYSTEMS

J. D. Cohen and J. S. Hoffman *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 569-578 refs (For primary document see N80-31588 22-28)

Avail: Issuing Activity CSCL 21/9

High density fuels show significant promise for increasing the range of volume limited aircraft. For weapons systems such as the current generation of subsonic cruise missiles, small aircraft are employed, propelled by air breathing turbine engines. It can be forecasted that the range of these craft will be nearly proportional to volumetric energy content of the proposed fuels, provided the fuels can be delivered and burned efficiently, and provided the impact on size and weight of the missile can be minimized. The impact of dense fuel use on combustion system design considerations is explored. E.D.K.

N80-31619* Hersh Acoustical Engineering, Chatsworth, Calif.

EFFECT OF GRAZING FLOW ON THE NONLINEAR ACOUSTIC BEHAVIOR OF HELMHOLTZ RESONATORS

A. S. Hersh *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 579-603 refs (For primary document see N80-31588 22-28)
(Contract NAS3-19745)

Avail: Issuing Activity CSCL 21/9

A semi empirical fluid mechanical model is derived of the acoustic behavior of thin walled single orifice Helmholtz resonators in a grazing flow environment. The model assumes that the flow field incident to a resonator orifice consists of a spherical sound particle velocity field superimposed upon a mean grazing flow. The incident and cavity sound fields are connected in terms of an orifice discharge coefficient whose values are determined experimentally using the two microphone method. With regard to its application to rocket motor interiors, the most important finding of this study is that the acoustic impedance of Helmholtz resonators is affected by grazing flow when the product of the amplitude of the sound pressure incident to the resonator orifice and the rocket motor interior mean grazing flow speed are less than 0.5. For values greater than 0.5, the acoustic impedance is independent of the grazing flow. E.D.K.

N80-31620 Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

ADMITTANCES AND CHARACTERISTIC COMBUSTION TIMES OF REACTIVE GASEOUS PROPELLANT INJECTORS

B. A. Janardan, B. R. Daniel, and B. T. Zinn *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 605-615 refs (For primary document see N80-31588 22-28)

Avail: Issuing Activity CSCL 21/9

The results of an experimental investigation undertaken to determine the effect of the number of elements in a coaxial injector upon the injector admittance and the characteristic combustion time are presented. The data indicate that for a fixed oxidizer and fuel flow rates and a given open area ratio of the injector, the frequency range during which the injector can sustain instabilities depends upon the number of injector elements. Also, data are presented that correlate the measured characteristic combustion times of the injector with the self driving periods of the experimental combustor. E.D.K.

N80-31621* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN AND EVALUATION OF HIGH PERFORMANCE ROCKET ENGINE INJECTORS FOR USE WITH HYDROCARBON FUELS

A. J. Pavli *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 617-643 refs (For primary document see N80-31588 22-28)

Avail: Issuing Activity CSCL 21/9

An experimental program to determine the feasibility of using a heavy hydrocarbon fuel as a rocket propellant is reported. A method of predicting performance of a heavy hydrocarbon in terms of to experimental test results. Combustion length effects were explored over a range of 21.6 cm. to 55.9 cm. Four injector types were tested, each over a range of mixture ratios. Further configuration modifications were obtained by reaming each injector several times to provide test data over a range of injector pressure drop. E.D.K.

N80-31622 AiResearch Mfg. Co., Torrance, Calif.

INVESTIGATION OF A PUTTY PROPELLANT TURBINE POWER SYSTEM

James C. Riple, Robert L. Schultz, and John C. Trowbridge *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 645-655 ref Prepared in cooperation with United Technologies Corp, Sunnyvale, Calif. (For primary document see N80-31588 22-28)

Avail: Issuing Activity CSCL 21/9

Uncured solid propellant is a viscous putty which can be pumped, extruded, and throttled. In turbine applications it provides control flexibility previously only available with liquid propellants, while retaining the safety, handling, storage, and cost advantages of solid propellants. Design concepts of a compact, lightweight turbine power system using uncured propellant were investigated for a short duration, intermittent duty application. Various propellant formulations were prepared and tested for ballistic,

rheological, and safety characteristics. A subscale gas generator and propellant high pressure pump were built and tested.Author

N80-31623 Physical Sciences, Inc., Woburn, Mass.
A MECHANISM FOR THE PHOTOCHEMICAL INDUCED COMBUSTION OF H2/F2 MIXTURES INHIBITED BY O2
P. Lewis, R. L. Taylor, and J. Cronin *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 657-668 refs (For primary document see N80-31588 22-28)
(Contract N00173-76-C-0190)
Avail: Issuing Activity CSCL 21/9

Using the most recent mechanisms and rate constants for the chemistry of the H2/F2/O2 molecular system, detailed modeling studies of stability data have shown that these data are explainable with reasonable accuracy. This same chemistry model was also used to explain the variation in performance of a H2/F2 pulsed chemical laser with added O2. The results show that although there is some gain in laser performance by operating at low O2 concentrations, the inverse linear dependence on O2 concentration rules out any dramatic increase in performance. E.D.K.

N80-31624*# Air Products and Chemicals, Inc., Allentown, Pa.
A STUDY OF INDUSTRIAL HYDROGEN AND SYNGAS SUPPLY SYSTEMS Final Report
W. J. Amos, J. Solomon, and K. F. Eliezer Oct. 1979 159 p Prepared for JPL
(Contracts NAS7-100; JPL-955421)
(NASA-CR-163523) Avail: NTIS HC A08/MF A01 CSCL 21D

The potential and incentives required for supplying hydrogen and syngas feedstocks to the U.S. chemical industry from coal gasification systems were evaluated. Future hydrogen and syngas demand for chemical manufacture was estimated by geographic area and projected economics for hydrogen and syngas manufacture was estimated with geographic area of manufacture and plant size as parameters. Natural gas, oil and coal feedstocks were considered. Problem areas presently affecting the commercial feasibility of coal gasification discussed include the impact of potential process improvements, factors involved in financing coal gasification plants, regulatory barriers affecting coal gasification, coal mining/transportation, air quality regulations, and competitive feedstock pricing barriers. The potential for making coal gasification the least costly H2 and syngas supply option. Options to stimulate coal gasification system development are discussed. A.R.H.

N80-31625*# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
A STUDY ON THE ELECTROLYSIS OF SULFUR DIOXIDE AND WATER FOR THE SULFUR CYCLE HYDROGEN PRODUCTION PROCESS Final Report
Jul. 1980 121 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955380)
(NASA-CR-163517; AESD-TME-3043) Avail: NTIS HC A06/MF A01 CSCL 21D

Experimental electrolysis cells using various platinum catalyzed carbon electrodes were tested. When operated at 200 mA/sq cm current density using 50 w/o acid at 50 C and 1 atm, a reference cell required 1.22 volts and degraded rapidly. After several improvements were incorporated into electrodes and the test cell configuration, a later cell required only 0.77 volts under identical operating conditions. At a lower current density, 100 mA/sq cm, the cell required only 0.63 volts. Kinetic studies on metal electrodes, measurements of temperature effects on electrode kinetics, investigations of electrocatalytic activities of metal electrodes over a wide range of acid concentrations, cyclic voltametric studies and evaluation of alternate catalysts were also conducted. From diffusivity experiments, a cation exchange membrane material, P-4010, exhibited an excellent diffusion coefficient, more than two orders of magnitude lower than that of rubber. Ionic resistivity measurements of eight materials showed that microporous rubber had the lowest resistivity. A.R.H.

N80-31626# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
SOME CIVIL ENGINEERING AND MANAGEMENT ASPECTS OF CONVERSION FROM JP-4 TO JP-8 FUEL BY THE UNITED STATES AIR FORCE IN THE CONTINENTAL UNITED STATES M.S. Thesis
Steven M. Pittman and J. Parke K. Smith Jun. 1980 96 p refs
(AD-A087221; AFIT-LSSR-5-80) Avail: NTIS HC A05/MF A01 CSCL 15/5

The purpose of this thesis is to examine the possible conversion in the CONUS from JP-4 turbine fuel to JP-8. While many studies have been conducted to analyze the effects of the conversion on aircraft and support systems there has been little work done to analyze the effects on the facilities in which the fuel is stored and transported. This thesis examines the effects of conversion on the fuel bulk storage tanks and on the piping and pumping system used to transport the fuel. Where appropriate, recommendations have been made concerning the modifications necessary to these facilities to counter any detrimental effects associated with the conversion. GRA

N80-31627# Department of Energy, Bartlesville, Okla. Energy Technology Center.
AVIATION TURBINE FUELS, 1979
Ella Mae Shelton May 1980 15 p refs
(DOE/BETC-PPS-80/2) Avail: NTIS HC A02/MF A01

Properties of some aviation turbine fuels marketed in the United States during 1979 are presented. The samples represented were typical 1979 production and were analyzed in the laboratories of 17 manufacturers of aviation turbine (jet) fuels. The data were submitted for study, calculation, and compilation. DOE

N80-31628# California Univ., Berkeley. Lawrence Berkeley Lab.
MULTIPHASE REACTOR MODELING FOR ZINC CHLORIDE CATALYZED COAL LIQUEFACTION M.S. Thesis
Peter James Joyce Apr. 1980 107 p refs
(Contract W-7405-eng-48)
(LBL-9870) Avail: NTIS HC A06/MF A01

A generalized reactor design was presented for a low temperature, coal conversion method, where coal was slurried in an 83 wt % zinc chloride methanol melt and allowed to react at moderate conditions of 275 deg C and 600 psi hydrogen. In the reactor, the slurried melt flowed downward in plug flow on the order of 1 foot per minute through a distance of 15 feet. Liquid mass-transfer studies with the model were undertaken to examine specific effects of zinc chloride in a viscous medium, in order to determine the rate-limiting step in the overall hydrogen absorption rate. The absorption rate can be expressed in terms of a resistance-in-series model. The use of zinc chloride introduces no new effects and the chemical reaction rate of the coal particle is controlling. DOE

N80-31629# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Oct. - Dec. 1979
R. F. Sullivan and D. J. Orear Jan. 1980 43 p refs
(Contract EX-76-C-01-2315)
(FE-2315-48) Avail: NTIS HC A03/MF A01

Current pilot plant results are presented for processing of H-Coal whole process product derived from Illinois No. 6 coal first, hydrotreating of the whole oil and, second, extinction recycle hydrocracking of the hydrotreated product. The 250F+ portion of severely hydrotreated Illinois H-Coal whole process product meets the jet fuel specifications for aromatics content, smoke, freeze, and flash points and almost meets the current specification for gravity and end point. The yield of 250F+ product is 90.4LV% based on feed. The diesel fuel oxidation stability of 300F+ hydrotreated products is excellent, even without additives. A large batch of low aromatic, denitrified Illinois H-Coal whole process product was prepared for downstream hydrocracking. In this preparation roughly 2100 SCF/bbl of hydrogen was consumed by the oil. The whole product from this hydrotreater was then cracked in an extinction recycle hydrocracker to make a 350F product. In this hydrocracking step, an additional 800 SCF/bbl of hydrogen was consumed by the oil. DOE

N80-31630# Institute of Gas Technology, Chicago, Ill.
PIPELINE GAS FROM COAL: HYDROGENATION (IGT HYDROGASIFICATION PROCESS) Interim Report, 1 Jul.

1977 - 30 Jun. 1978
May 1980 384 p refs
(Contracts EX-76-C-01-2434; EF-77-C-01-2434; E(49-18)-2434; Proj. 9000)
(FE-2434-33a; IR-2) Avail: NTIS HC A17/MF A01

Tests were conducted to acquire data with bituminous coal at high carbon conversions and to obtain data at high char conversions with high char throughputs. Tests were conducted to determine whether the major modifications recently incorporated would facilitate optimum operating conditions and clinker-free operation. Tests were conducted to optimize reactor operation by improving char conversion, increasing the temperature in the steam-oxygen gasifier to 1800 F, and continuing to reduce the steam-to-char ratios. Test were initiated to achieve a lower steam-to-char ratio and a significantly lower superficial gas velocity in the steam-oxygen gasifier. DOE

N80-31631# Rockwell International Corp., Canoga Park, Calif. Environmental and Energy Systems Div.
MOLTEN SALT COAL GASIFICATION PROCESS DEVELOPMENT UNIT Quarterly Technical Progress Report, Jul - Sep. 1979
M. H. Slater 19 Oct. 1979 31 p
(Contract EF-77-C-03-1429)
(SAN-1429-56; QTPR-14) Avail: NTIS HC A03/MF A01

The design construction, and operation of a process development unit (PDU) which will convert 1 ton of coal per hour into low-Btu gas is presented. Details were complete and all parts were fabricated for the melt withdrawal system modifications designed to increase the reliability of the system. The fabrication of pressure-rated gas burners for the melt withdrawal system was initiated. These heaters operate over the entire pressure range of PDU testing; i.e., from one atmosphere through 20 atmospheres. DOE

N80-31632# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
FOSSIL FUELS RESEARCH MATRIX PROGRAM. US ENVIRONMENTAL PROTECTION AGENCY/DEPARTMENT OF ENERGY FOSSIL FUELS RESEARCH MATERIALS FACILITY
W. H. Griest and M. R. Guerin Jun. 1980 52 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7346) Avail: NTIS HC A04/MF A01

Health and environmental-effects studies of alternate fossil fuels technologies were conducted. Sets of sample differing in some systematic manner (e.g., coal-, shale-, and petroleum-derived counterparts; processing history; etc.) were brought to the attention of investigators expert in various biological and chemical tests systems. The result is a series of matrix experiments whereby various groups apply a variety of tests to given sets of samples. The matrix program provides a convenient source of useful samples and guidance on sample characteristics and data gaps in exchange for results of the individual investigations. DOE

N80-31633# Dravo Corp., Pittsburgh, Pa. Chemical Plant Div.
PITTSBURGH ENERGY TECHNOLOGY CENTER HYDROGASIFICATION PROCESS: CONCEPTUAL COMMERCIAL SCALE PLANT DESIGN
28 Dec. 1979 115 p refs
(Contract DE-AC21-78MC-08484)
(DOE/MC-08484/T1) Avail: NTIS HC A06/MF A01

Hydrogasification pilot plant tests at various H2:coal ratios and coal throughputs or North Dakota lignite, Illinois No. 6 and a Western sub-bituminous coal were reviewed. Additional testing at higher H2:coal ratios confirmed that greater coal throughputs were possible. Conceptual commercial scale plant designs based on the North Dakota lignite and the Illinois No. 6 coal showed total plant investment figures of $1668 MM and $1998 MM for the two coals, respectively. Gas costs based on the Unitity Finance Method of calculation yielded costs ranging from $4.91/MM Btu and $5.26/MM Btu for lignite at $5.00 and $8.00 per ton. Corresponding figures for the Illinois No. 6 coal were gas costs of $6.08 to $6.73 for coal costs of $20 and $30 per ton, respectively. Gas cost sensitivity analyses are performed. Further study of the process is warranted. DOE

N80-31634# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.
ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
31 Aug. 1979 68 p
(Contract EF-77-C-01-1514)
(FE-1514-101) Avail: NTIS HC A04/MF A01

Additional testing of the gasifier-agglomerator reactor included direct coal feed as well as oxygen-blown gasification of a char or coal bed. Support work on fuel processing was conducted to investigate operating conditions for the process development unit test program, provide troubleshooting capability for PDU operation, obtain data for PDU modifications, analyze and interpret results from PDU operation, develop process models for scale-up, and understand process phenomena to achieve reliable operation. Work was conducted in the areas of cold flow and analytical modeling, coal behavior, coal and ash chemical phenomena, environmental impact, and process and systems engineering consultation. DOE

N80-31635# Air Products and Chemicals, Inc., Allentown, Pa.
CRYOGENIC METHANE SEPARATION/CATALYTIC HYDROGASIFICATION PROCESS ANALYSIS Quarterly Report, 15 Oct. 1978 - 15 Jan. 1979
16 Jan. 1979 19 p
(Contract ET-78-C-01-3044)
(FE-3044-T7) Avail: NTIS HC A02/MF A01

Efforts were directed towards identifying the most attractive acid gas removal systems, per case, based on preliminary screenings. Using proprietary information obtained from the respective vendors of the Benfield and Rectisol acid gas removal processes, preliminary cost estimates were complete for the Exxon CCG process. Several sets of computer simulations, for different acid gas removal configurations, for the Selexol process were developed to optimize methane recovery and utility savings. DOE

N80-31636# Institute of Gas Technology, Chicago, Ill.
PIPELINE GAS FROM COAL: HYDROGENATION (IGT HYDROGASIFICATION PROCESS) Quarterly Report, 1 Oct. - 31 Dec. 1979
May 1980 75 p
(Contract EX-76-C-01-2434)
(FE-2434-58; QR-14) Avail: NTIS HC A04/MF A01

A data base to optimize the design of the HYGAS process Test 83 operations was established and post run inspection was conducted to determine the operating behavior of washed Kentucky coal under process conditions. After smooth, continuous solids transfer could not be established through the 339 line from the high temperature reactor to the steam/oxygen gasifier, the test was terminated. Several holes and a crack found in solids transfer line 339 during the post run inspection were the source of these difficulties. Test 84 was the second test of a new series with Western Kentucky coal, and the objectives were the same as those of Test 83. The reactor operated in a self sustained mode for 215 hours, during which 317 tons of pretreated char were fed to the gasifier. Three steady state periods totaling 83.5 hours, were selected for detailed analysis. Routine maintenance and major turnaround work in preparation for test 85 was started. DOE

N80-31637# Institute of Gas Technology, Chicago, Ill.
COAL GASIFICATION PILOT PLANT SUPPORT STUDIES Quarterly Report, 1 Apr. - 30 Jun. 1979
Jan. 1980 162 p refs
(Contract ET-78-C-01-2805)
(FE-2806-5) Avail: NTIS HC A08/MF A01

Improving pilot plant operation, achieving expected conversion, and effecting cost savings are discussed. Projects are classified into four tasks as follows: (1) studies of gasification reactions for improving the performance of coal gasification reactors; (2) studies of fluidized bed reactors in coal gasification processes; (3) studies to improve the processing techniques of product and waste gases from coal gasification; and (4) studies to improve methods of feed preparation for coal gasification. Each task is further divided into a number of subtasks dealing with specific aspects of the task. The objectives of the subtasks

and their technical progress during the last quarter (April 1 through June 30, 1979) are presented. DOE

N80-31638# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
ADVANCED DEVELOPMENT OF A SHORT-RESIDENCE-TIME HYDROGASIFIER Annual Technical Progress Report
21 Jan. 1980 153 p refs
(Contract ET-78-C-01-3125)
(FE-3125-12) Avail: NTIS HC A08/MF A01

Relocation and modification of the subscale hydrogasifier test facility to accommodate longer duration testing was accomplished. A joint decision was made to scale the previously planned 1/4-TPH system to a nominal 3/4-TPH system. The required adjustments were primarily in the form of line size changes which were implemented during the installation of the process piping. Additional modifications to the reactor train support structure and handling capability were made to accommodate the larger reactor pressure vessel, having an 11.75 in. inside diameter. Facility modifications are planned to provide capability for simulated recycle gas feed, and provide for more representative sampling for improved material balances. DOE

N80-31639# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
ADVANCED DEVELOPMENT OF A SHORT-RESIDENCE-TIME HYDROGASIFIER Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980
Apr. 1980 152 p refs
(Contract ET-78-C-01-3125)
(FE-3125-18) Avail: NTIS HC A08/MF A01

Progress in the development of test facilities for the hydrogasification of coal and peat is described. The surveillance of materials for components and carbon conversion efficiency are discussed. DOE

N80-31640# IIT Research Inst., Chicago, Ill.
DESIGN, ENGINEERING AND EVALUATION OF REFRACTORY LINERS FOR SLAGGING GASIFIERS Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
R. F. Firestone, C. Hales, and M. J. Greaves Jan. 1980 27 p Prepared in cooperation with McKee (Davy) Corp., Cleveland
(Contract ET-78-C-01-2785)
(IITRI-M-6043-5; QTPR-5) Avail: NTIS HC A03/MF A01

Temperatures in slagging gasifiers are in the 2500 T to 3300 F range which limits the materials which can be used. In addition the combination of high pressure (up to 1500 psi) with water vapor and the presence of carbon monoxide and hydrogen can present corrosion problems for refractories. Low iron, high alumina refractories are the presently preferred materials for coal gasification plants. The atmospheres and other conditions found in vessels used in coal gasification require the use of dense and insulating high Al2O3 refractory shapes and castables. Low SiO2 and low Fe2O3 refractories are necessary to resist steam and CO. In processes that involves molten carbonates or where slag may run down walls, fused cast Al2O3 is used to avoid corrosion and erosion. Considerable research is required to establish optimum refractory systems and design methods for slagging coal gasifiers. DOE

N80-31641# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS Final Report
D. C. Succop and F. E. Wynne Mar. 1980 98 p
(Contract EX-76-C-01-1800)
(FE-1800-45) Avail: NTIS HC A05/MF A01

The conversion of coal to synthetic gasoline and other distillate motor fuels, by delayed coking of a coal/petroleum resid slurry with an associated displacement of petroleum residual to the fluid catalytic cracking unit was studied. The cooking process met or exceeded technical and economic predictions. Ambient pressure coking experiments with two different coal slurries demonstrated synergistic increases in C3(+) distillate yield and product quality. Slurry viscosity measurements and heater fouling tests indicated only slightly pseudo-plastic slurry behavior and no unusual pumping resistance of pressure drop in slurry heaters. However, above 814 F rapid coking and heater fouling was experienced. Laboratory hydrogen transfer mechanism studies led to the conclusion that no C-C transfer occurred during coking. The process appears to be that of general H-H scrambling, perhaps promoted by the presence of a metal reactor and/or coal mineral matter functioning as a catalyst. DOE

N80-31642# North Dakota Univ., Grand Forks. Dept. of Chemistry.
CHEMISTRY OF LIGNITE LIQUEFACTION Quarterly Report, Jul. - Sep. 1978
Virgil I. Stenberg, Richard Baltisberger, Kenneth J. Kalbunde, Neil F. Woolsey, Donald Severson, and Max Souby Oct. 1978 82 p refs
(Contract EX-76-C-01-2211)
(FE-2211-11) Avail: NTIS HC A05/MF A01

Various results related to the liquefaction of lignite are reported. The structural chemical analysis of oxygen and nitrogen compounds in coal liquids is facilitated by acetylation. Solvent refined lignite and solvent refined coal were hydrogenated using a variety of catalysts. The resulting liquids were fractionated by distillation and examined by mass spectroscopy and nuclear magnetic resonance. Model compounds were reduced using carbon monoxide-water or hydrogen using various catalysts (among others fly ash) in an effort aimed at reducing the severity of coal liquefaction conditions. Electron transfer from thermally activated magnesium oxide powder to nitrobenzene and adsorbed carbon monoxide was also studied. DOE

N80-31643# Los Alamos Scientific Lab., N. Mex.
HYDROGEN PRODUCTION FROM THE SOLAR BASED LASL CADMIUM CYCLE
C. F. V. Mason, M. G. Bowman, and R. G. Behrens 1980 6 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1400; CONF-800806-2) Avail: NTIS HC A02/MF A01

A thermochemical H2 cycle is presented where the high temperature step can be powered by a solar heat source. The cycle consists of three reactions: the thermal decomposition of CdO and CdCO3 and the oxidation of Cd using water and CO2 to form CdCO3 and H2. Experimental data is presented which indicates that CdO(g) is less stable than previously thought. Kinetic studies of the H2 producing reaction show both Pd and NH4Cl to be good catalysts. NH4Cl, although introducing more possibilities for side reactions, appears to be the better catalyst. Drying studies on CdCO3 show that water retention problems are minimal. DOE

N80-31644# Engineering Societies Commission on Energy, Inc., Washington, D. C.
MATERIALS FOR COAL CONVERSION AND USE. VOLUME 2: MATERIALS OF CONSTRUCTION FOR COAL CONVERSION SYSTEMS. PART 1: COAL GASIFICATION. PART 2: COAL LIQUEFACTION Final Report
Vinod K. Nangia Oct. 1979 409 p refs
(Contract EF-77-C-01-2468)
(FE-2468-59-Vol-2-Pt-1/2) Avail: NTIS HC A18/MF A01

The principles of coal gasification and liquefaction are reviewed and the various technologies and equipment used are examined. Present and past work on the behavior of materials in coal conversion and use environments is reported. Available data are evaluated and problems areas relcted to materials are identified. Operating conditions are defined for these technologies in terms of temperature, pressure, erosive and corrosive environments, and their effects on the construction materials. Candidate materials are proposed based on extrapolation of the available data and related experience from other technologies. Areas needing further research and development are recommeneded. DOE

N80-31645# TRW Energy Systems Planning Div., McLean, Va.
METHANE RECOVERY FROM COALBEDS PROJECT, PHASE 2 Annual Report, 1979
1979 101 p
(Contract DE-AC21-78MC-08089)
(DOE/MC-08089/T4) Avail: NTIS HC A06/MF A01

Field activities relating the estimation of the methane resources contained in the nation's coalbeds and the determination of exploration and production technologies that allow extrapolation from test sites to larger resource areas are reported. Projects goals and management are also addressed. DOE

N80-31646# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
LIQUID FUELS FROM BIOMASS: CATALYSTS AND REACTION CONDITIONS
Manu Seth, Sabri Ergun, Ted Vermeulen, and Roger Djafar Apr. 1980 72 p refs
(Contract W-7405-eng-48)
(LBL-9789) Avail: NTIS HC A04/MF A01

The use of alpha-phellandrene as a hydrogen transfer agent in wood liquefaction was studied at 200 C. No significant thermally promoted hydrogen transfer occurred under these conditions. Dilute sulfuric acid was added to test the possibility of hydride transfer from alpha-phellandrene to wood. Extensive solvent alkylation of the wood occurred in the presence of up to 2 wt % of sulfuric acid. Addition of palladium as a hydrogenation catalyst resulted in lower overall conversion based on the toluene-insoluble residue obtained, and in lowered levels of solvent alkylation. Several inorganic salts were tested as catalytic additives for wood liquefaction at 250 C in the presence of tetralin as a possible hydrogen donor. No hydrogen transfer from the solvent was observed. Of the additives tested, nickel chloride, sodium carbonate, and ferric chloride resulted in wood conversions greater than or equal to those obtained in the absence of an additive. DOE

N80-31647# Battelle Columbus Labs., Ohio.
ECONOMIC EVALUATION OF THE MIT PROCESS FOR MANUFACTURE OF ETHANOL
D. M. Jenkins and T. S. Reddy 28 Jun. 1979 32 p refs
(Contract ET-78-X-01-3992)
(DSE-3992-T1) Avail: NTIS HC A03/MF A01

Conceptual process designs were developed for two cases, Case A which was based on the experimental data obtained to date, and Case B which hypothesized the suppression of acid byproducts. Economic estimates may be slightly on the low side since they did not consider feedstock storage nor working capital requirements. The manufacturing costs for Case A appeared to be comparable to those of the manufacture of ethanol from corn. The plant size used for this analysis was 1500 ton/day corn stover. This is considered to be a realistic size. The conceptual plants make about 27 million gal/yr ethanol in Case A and 41 million gal/yr in Case B. DOE

N80-31648# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SURVEY OF BIOMASS GASIFICATION. VOLUME 3: CURRENT TECHNOLOGY AND RESEARCH
Apr. 1980 302 p refs 3 Vol.
(Contract EG-77-C-01-4042)
(SERI/TR-33-239-Vol-3) Avail: NTIS HC A14/MF A01

This survey of biomass gasification was written to areas of gasification that are ready for commercialization now and those areas in which further research and development will be most productive. Consideration is given to: a survey of gasifier types; a directory of current manufacturers of gasifiers and gasifier development programs; and a sampling of gasification research and development programs and their unique features. Air gasification for the conversion of existing gas/oil boiler systems to biomass feedstocks is compared with the price of installing new biomass combustion equipment. Chapter 12 treats gas conditioning as a necessary adjunct to all but close-coupled gasifiers, in which the product is promptly burned. Synthesis gas processes for conversion to methanol, ammonia, gasoline, or methane are evaluated technically and economically. DOE

N80-31649# Dynatech R/D Co., Cambridge, Mass.
PEAT BIOGASIFICATION DEVELOPMENT PROGRAM Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
1979 28 p refs
(Contract DE-AC01-79ET-14696)
(DOE/ET/14696-T1) Avail: NTIS HC A03/MF A01

The effects of different alkalis, temperatures, and oxygen partial pressures on the solubility of peat organic material were determined. Multi-stage pretreatment was investigated by pretreating the effluent from previous NaOH pretreatment cooks. Bacteria from three inoculation sources are being grown anaerobically on a growth medium containing a standard nutrient medium and one of twelve aromatic compounds. The concentration of aromatic compound is increased gradually to acclimate the bacteria to compounds which may result from peat pretreatment. A preliminary design for a full scale peat biogasification plant developed. The plant is designed to produce 75 millions SCFD of pipeline quality methane. Major segments of the plant are concerned with the transport, handling, pretreatment, and fermenting of the aqueous peat slurry, and the purification of the resulting methane gas. R.K.G.

N80-31650# Solar Turbines International, San Diego, Calif. Applied Sciences Div.
AUTOMOTIVE STORAGE OF HYDROGEN USING MODIFIED MAGNESIUM HYDRIDES Final Report, Mar. 1978 - Mar. 1978
D. A. Rohy, J. F. Nachman, A. N. Hammer, and T. E. Duffy 1979 82 p refs
(Contract EY-76-C-03-1167)
(SAN-1167-1) Avail: NTIS HC A05/MF A01

Due to the relative stability of MgH2, modifications of the MgMH/sub x/ (M = metal ion) were made to decrease the dissociation temperature while retaining high hydrogen capacity. This parameter is crucial since vehicle exhaust will supply the thermal energy to dissociate the hydride in an automobile. Hydride dissociation temperature (T/sub D/) should be 200 C to ensure uninterrupted fuel flow at all driving and idle conditions. Alloys comprised of Mg, Cu and Ni came closest to meeting the dissociation temperature goal. Dissociation temperature, hydrogen capacity and material cost are reported for each alloy tested in this program. DOE

N80-31651# General Atomic Co., San Diego, Calif.
HYDROGEN PRODUCTION BY THE GA SULFUR-IODINE PROCESS
G. E. Besenbruch, K. H. McCorkle, J. H. Norman, D. R. OKeefe, J. R. Schuster, P. W. Trester, and M. Yoshimoto (Idemitsu Kosan Co., Ltd., Tokyo) May 1980 17 p Presented at the 3d World Hydrogen Energy Conf., Tokyo, 23 Jun. 1980
(Contract DE-AC02-80ET-26225; Proj. 3260)
(GA-A-15777-Rev; CONF-800616-6-Rev) Avail: NTIS HC A02/MF A01

The progress of the overall total development effort of the General Atomic (GA) sulfur-iodine thermochemical water splitting cycle over the last two years is summarized. The major accomplishments were significant improvements in the chemistry of the process; development, review, and revision of an engineering flow sheet, resulting in a thermal process efficiency of 47%; screening, identification, and testing of potential materials-of-construction for the corrosive process fluids; small-scale demonstration of the cycle in a closed loop under recycle conditions; installation of bench-scale equipment and demonstration of parts of the processing in this system; and development of a conceptual, preliminary flowsheet for the GA sulfur-iodine cycle driven by solar energy. Thermochemical water splitting by the sulfur-iodine cycle is a feasible process. Thermal efficiencies in the range of 50% are achievable. DOE

N80-31652# California Univ., Livermore. Lawrence Livermore Lab.
GASIFICATION OF COAL WITH SOLAR ENERGY
William R. Aiman and David W. Gregg Jun. 1980 28 p refs Presented at 88th Natl. Meeting of the AIChE Conf., Philadelphia, 8-12 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-84458; CONF-800610-8) Avail: NTIS HC A03/MF A01

Coal reactors are adaptable to solar-energy facilities. Two advantages make solar coal gasification attractive economically: synthesis gas (a nitrogen-free product) can be produced without pure oxygen and only half as much coal is required. Solar energy is available 8 hours per day; therefore, post-gasification processing units must be oversized and equipped for rapid startup and shutdown. This disadvantage is balanced by the 50 percent

reduction cost for coal and coal pretreatment equipment and in the sulfur content of the product gas. A moving bed reactor, a fluidized bed reactor, a closed-loop, heat-transfer-fluid reactor, and an open-loop, heat-transfer-fluid reactor are discussed. The expected performance of a moving-bed gasifier yields products with an energy content 25 percent higher than the initial coal compared to 17 percent higher for a fixed-bed gasifier. DOE

N80-31653# Gulf Research and Development Co., Pittsburgh, Pa. Chemical and Minerals Div.

UNDERGROUND GASIFICATION FOR STEEPLY DIPPING COAL BEDS. RAWLINS TEST NO. 1

1980 29 p Prepared in cooperation with TRW Energy Systems Planning Div., McLean, Va.

(SAN-13108-35; Rept-624RL106) Avail: NTIS HC A03/MF A01

The first US field test of gasification for a steeply dipping coal seam was recently completed. A 23 ft thick coal bed dipping at 63 was used to test the feasibility of using underground coal gasification techniques to extract energy from steeply dipping coal beds. The coal was ignited at a vertical depth of 400 ft utilizing a directionally drilled process well pair. The test was designed to investigate the effects of water/air injection, steam/air injection, and steam/oxygen injection. According to plan approximately 1200 tons of coal were utilized during the test. The heating value of the product gas initially climbed to approximately 180 Btu/SCF and as expected, gradually declined to the 120 to 130 Btu/SCF range. A five day steam/oxygen blown experiment was conducted subsequent to the steam/air phase. As expected steam/oxygen injection easily doubled the product gas heating value to the 240 to 260 Btu/SCF range. DOE

N80-31654# California Univ., Livermore. Lawrence Livermore Lab.

LLL IN SITU COAL GASIFICATION PROJECT Quarterly Progress Report, Oct. - Dec. 1979

Robert J. Cena, ed. and Barbara S. Strack, ed. 23 Apr. 1980 40 p refs Sponsored in part by Gas Research Inst.

(Contract W-7405-eng-48)

(UCRL-50026-79-4) Avail: NTIS HC A03/MF A01

Thermal data were analyzed to determine the performance of the drilled horizontal channel during forward gasification. Thermal and material balance data were combined to determine late time burn boundaries for the experiment. Process wells were inspected to determine failure characteristics and pinpoint late-time injection location. Ground water quality before and after Hoe Creek No. 3 and the effects of aquifer interconnection on hydraulic measurements at the Hoe Creek No. 2 and No. 3 sites are discussed. DOE

N80-31655# Sandia Labs., Albuquerque, N. Mex. Thermal Processes Div.

INSTRUMENTATION AND PROCESS CONTROL DEVELOPMENT FOR IN SITU COAL GASIFICATION Quarterly Report, 1 Dec. 1979 - 31 Mar. 1980

Robert E. Glass, ed. Jun. 1980 26 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-1025) Avail: NTIS HC A03/MF A01

The Hanna 4B thermal data was analyzed with respect to the fundamental controlling mechanisms in in situ coal gasification. Two of the concerns center on: (1) the behavior of the reservoir with respect to varying permeability zones and (2) mechanisms of initial cavity growth during forward gasification. In an attempt to deal with these concerns, two specific areas of interest are being pursued: (1) a reservoir model with variable permeability; and (2) a structural model of the coal seam using the finite element program ADINA. While these models remain in the development stage, initial results indicate that the approaches being used will yield useful results when completed. DOE

N80-31656# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.

MIXING AND GASIFICATION OF COAL IN ENTRAINED FLOW SYSTEMS. VOLUME 2: USER'S MANUAL FOR A COMPUTER PROGRAM FOR 1-DIMENSIONAL COAL COMBUSTION OR GASIFICATION (1-DICOG) Final Report

L. Douglas Smoot and Philip J. Smith 31 Aug. 1979 215 p refs Sponsored in part by Electric Power Research Inst.

(Contract EF-77-S-01-2666)

(FE-2666-F-Vol-2) Avail: NTIS HC A10/MF A01

A one dimensional, steady state model describing pulverized coal combustion and gasification is presented. Emphasis is placed on the description of the coal reaction processes and gas particle interactions, one dimensional fluid mechanics and particle-particle, particle-wall radiation. Moisture vaporization from the coal particles, multistep coal pyrolysis, and heterogeneous char oxidation by multiple oxidizers were modeled for polydispersed coal particle size or types. Although the formation was one dimensional, mixing rates of primary and secondary streams and recirculation within the reactor were accounted for as specified input. The resulting model predicted thermal, chemical and physical histories for both the gaseous and particle phases. Gas-particle interactions accounted for appropriate diffusion and kinetic rates. Gas phase reactions were assumed to be in local chemical equilibrium. The solution technique used predictor-corrector methods for integration of the ordinary nonlinear differential equations which were coupled with a number of auxiliary algebraic equations. DOE

N80-31657# Department of Energy, Washington, D. C. Office of Advanced Conservation Technologies.

HYDRIDES VERSUS COMPETING OPTIONS FOR STORING HYDROGEN IN ENERGY SYSTEMS

James H. Swisher and Edward D. Johnson (OAO Corp., Washington, D.C.) 7 Apr. 1980 43 p refs Presented at Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7 Apr. 1980

(Contract DE-AC01-79CS-60478)

(CONF-800402-13) Avail: NTIS HC A03/MF A01

Hydrogen storage in metal hydrides was compared to other forms of hydrogen storage. Comparisons were made using technical performance, cost, and safety as the criteria. Hydrides applications and alternatives for vehicular applications, chemical heat pumps, engines, peak shaving, and others were examined. DOE

N80-31658# Department of Energy, Pittsburgh, Pa. Energy Technology Center.

RECENT COAL-OIL MIXTURE COMBUSTION TESTS AT PETC

Y. S. Pan, G. T. Bellas, M. P. Mathur, J. I. Joubert, and D. Bienstock Jun. 1980 38 p refs

(DOE/PETC-TR-80/5) Avail: NTIS HC A03/MF A01

Coal-oil mixture combustion tests with coal concentration of up to 50 percent were successfully conducted in a 700 horsepower watertube boiler designed originally for oil firing. A 500 h duration test with coal-oil mixture containing 40 percent coal was completed. No derating of the boiler occurred, carbon-conversion efficiencies were above 98 percent, and boiler efficiencies were the same as when firing No. 6 fuel oil. All combustion tests were conducted with No. 6 fuel oil mixed with Pittsburgh Seam coal pulverized to a coal particle size of 90 percent minus 200 mesh. Test results relating to boiler performance, pollutant emissions, ash deposition, and corrosion, erosion, and fouling behavior are presented. DOE

N80-31659# Institute of Gas Technology, Chicago, Ill.

DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW-Btu GASES AS INDUSTRIAL PROCESS FUELS: MODIFICATION OF FLAME CHARACTERISTICS Quarterly Report, 1 Jan. - 31 Mar. 1980

Richard T. Waibel Apr. 1980 7 p

(Contract DE-AC01-79ET-14851)

(DOE/ET-14851/2) Avail: NTIS HC A02/MF A01

The burner modifications that yield suitable flame characteristics and shapes with oxygen blown gases manufactured from coal were determined. Methods of enchancing the flame characteristics of manufactured gases from air-blown gasifiers were evaluated. DOE

N80-31660# National Technical Information Service, Springfield, Va.

SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WASTES. CITATIONS FROM THE NTIS

DATA BASE Progress Report, 1964 - Jun. 1980
Audrey S. Hundemann Jun. 1980 230 p Supersedes NTIS/PS-79/0545; NTIS/PS-78/0499
(PB80-811375; NTIS/PS-79/0545; NTIS/PS-78/0499) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

Research efforts directed toward production of gaseous and liquid synthetic fuels from solid wastes are discussed. Waste products used in the syntheses include manure, sewage, paper, and wood. In most citations, methane is the primary fuel produced; however, the production of oils, methanol, and ethanol is also discussed. This updated bibliography contains 218 abstracts, 54 of which are new entries to the previous edition. GRA

N80-31661# Office of Technology Assessment, Washington, D. C.
TAGGANTS IN EXPLOSIVES
Apr. 1980 270 p refs
(PB80-192719; OTA-ISC-116; LC-80-600070) Avail: NTIS HC A12/MF A01 CSCL 19A

Issues surrounding a proposal to require that commercial explosives and gunpowders carry 'identification taggants' and/or 'detection taggants' as an aid to law enforcement are examined. Four major questions are addressed: (1) it reviews the program to develop such taggants and addresses the question of whether taggants would work; (2) it assesses whether taggants might create a safety hazard; (3) the cost of a taggant program is calculated, and (4) the likely value of such a program to law enforcement is assessed. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-31662 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 7
Judith Nagle-Eshleman, ed. Jul. 1980 96 p refs
(AD-A087855) Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00

The causes of rotor instability are addressed with emphasis on internal damping, dry friction, and bearing forces. The factors involved in the mathematical modeling of fluid transients in machines are also considered. For individual titles, see N80-31663 through N80-31664.

N80-31663 Kobe Univ. (Japan).
STABILITY PROBLEMS OF ROTOR SYSTEMS c37
T. Iwatsubo *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 3-8 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00

A review of the literature published in 1978 and 1979 on instability in rotor systems is presented. Instability due to internal damping, dry friction, bearing forces, fluid forces, parametric excitation, torsional and torsional lateral vibration, and asymmetric elements are included. J.M.S.

N80-31664 Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
MODELING OF FLUID TRANSIENTS IN MACHINES, PART 2: ADVANCED CONSIDERATIONS c34
R. Singh *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 11-17 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00

A state-of-the-art literature review is presented with emphasis on advanced mathematical modeling considerations. The following topics are discussed: modeling of turbomachinery and positive displacement machinery; dynamic coupling of machines; transient behavior of machinery systems and installations; multidimensional transients; two phase flow; interaction between wave propagation and fluid flow modes; and experimental modeling methods. R.C.T.

N80-31665 California Univ., San Diego, La Jolla.
SEISMIC STABILITY OF BLOCK STRUCTURES Ph.D. Thesis
Richard Luttrell Furgerson 1980 120 p
Avail: Univ. Microfilms Order No. 8018779

When studying earthquake damage reinforced concrete or concrete masonry structures, it was observed that the mechanisms of failure are often simple ones; the vulnerable connections between structural components degrade under stress allowing the major substructures to separate, lose support, and topple. This type of failure is said to result from kinetic instability. For the purpose of analysis, structures with degraded connections are modeled as assemblages of rigid substructures with only friction acting between them. A statistical analysis of data from experiments on concrete masonry members gives an asymptotic Coulomb law describing this friction which is included in the model equations of motion. The equations of motion for a simple shear wall floor slab assemblage subjected to simulated earthquake loading are solved numerically. The result shows a surprisingly well defined relation between the maximum amplitude of excitation, the natural frequency of the structure, and a numerically valued hazard from kinetic instability. When presented graphically, the result allows a designer to assess hazard from kinetic structural instability by inspection. Dissert. Abstr.

N80-31666 Mississippi State Univ., State College.
DEVELOPMENT AND EVALUATION OF THE EPOXY REPAIR METHOD FOR REINFORCED CONCRETE FLEXURAL MEMBERS Ph.D. Thesis
Sak Kongsuwan 1980 232 p
Avail: Univ. Microfilms Order No. 8021117

Repair procedures were developed based on both the evaluation of the past epoxy repair methods and the pilot study in this research. Fifteen reinforced concrete beams were failed in flexure to produce failures ranging from light to heavily damaged. The damaged beams were repaired using the methods developed and tested. It was concluded that it is possible to repair failed reinforced concrete beams (particularly in flexure) by using the developed repair method. The loading capacity of a repaired beam was verified both experimentally and theoretically as being restorable to approximately the same level as of the original beam regardless of the type and degree of failure. The durability of repaired beams, subjected to cycle loading, is somewhat less than the durability of the original beams. The decrease of durability of the repaired beams is attributed by the softening of steel, the amount of epoxy present in the concrete, and the presence of microcracks. Repaired beams which were failed by one cycle loading were found to behave identically to the original undamaged beams. Dissert. Abstr.

N80-31667*# Northern Research and Engineering Corp., Woburn, Mass.
US COAST GUARD LIGHTWEIGHT FIRE-FIGHTING MODULE Final Report
15 May 1980 117 p
(Contract NAS8-31977)
(NASA-CR-161552; NREC-1296-1) Avail: NTIS HC A06/MF A01 CSCL 13B

The U.S. Coast Guard Fire-fighting Module developed for the purpose of fighting fires in harbors and on ships is described. The module can be lifted by a dockside crane or helicopter and placed on the deck of a patrol boat or cutter for transportation to the scene of the fire. At the fire the module can be set up and put in operation by a crew of two in approximately fifteen minutes. Once in operation the module will deliver water to two fire nozzles at a pressure of 150 psi and a flow rate of 2000 gpm. Sufficient fuel is carried in the module for three hours of continuous operation. A record of the development of the fire fighting module is also presented. L.F.M.

N80-31668# Aeronautical Research Labs., Melbourne (Australia).
REDUCTION IN SWING OF A SONAR BODY WINCHED FROM THE SEA BY A HELICOPTER
N. E. Gilbert Aug. 1979 23 p refs
(ARL/AERO-NOTE-395; AR-001-766) Avail: NTIS

HC A02/MF A01

To avoid the possibility of collision with the helicopter, an automatic procedure is proposed in which the sonar body is alternately raised and lowered during defined periods of each oscillation. When the prescribed degree of damping is achieved, the body is raised continuously to the trail position. Performance of the method is judged by the amount of additional raise time required. L.F.M.

N80-31669# Earthquake Engineering Research Inst., Berkeley, Calif.

UNDISTURBED SAMPLING AND CYCLIC LOAD TESTING OF SANDS

Sukhmander Singh, H. Bolton Seed, and Clarence K. Chan Dec. 1979 147 p refs

(Contracts DACW39-77-M-0859; DACW39-78-M-2016)

(AD-A087298; UCB/EERC-79/33) Avail: NTIS HC A07/MF A01 CSCL 08/13

The influence of sampling disturbance on the cyclic strength characteristics of sands was evaluated. Sampling types studied include block sampling by advance trimming and sampling, push-tube sampling and a freezing technique. It is shown that block sampling caused minimal density changes and provides a very high quality sample. The push-tube sampling method caused density changes and the less resistant structure of virgin soil deposits underwent pronounced density changes. It is further indicated that if the confining pressure is maintained and drainage is not impeded the volume changes during freezing are insignificant and the cyclic strength characteristics are not altered. It is concluded that the influence of disturbance due to sampling handling requires careful interpretation in evaluating the significance of cyclic load test data. R.K.G.

N80-31670# Bendix Corp., Kansas City, Mo.

FABRICATION FOR PRECISION MECHANISMS Final Report

L. K. Gillespie Mar. 1980 103 p refs

(Contract DE-AC04-76DP-00613)

(BDX-613-2388) Avail: NTIS HC A06/MF A01

Twenty-five manufacturing operations were studied to improve the precision of existing machining and assembly techniques. The study included the machining of metals and plastics using techniques new to the manufacture of miniature switches, timers, and actuators. Drilling, tapping, and press-fitting miniature features were evaluated. Fixturing and handling techniques, friction reduction, and the forming of ceramic parts were also studied. Many of the new approaches from this study were incorporated into existing processes and further refined. DOE

N80-31671# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.

GRAVITATIONAL CONVECTION OF SUBCOOLED He 1 AND THE TRANSITION INTO SUPERFLUID He 2 AT ATMOSPHERIC PRESSURE

S. Caspi Jun. 1980 7 p refs Presented at the 8th Intern. Cryogenic Eng. Conf., Genoa, 3-6 Jun. 1980

(Contract W-7405-eng-48)

(LBL-10928; CONF-800631-2) Avail: NTIS HC A02/MF A01

The propagation velocity of the He 2-He 1 interface at 1 atm was measured in a large experimental cryostat. During cooldown, He 2 at the lambda temperature propagates up and down in a gravitational field with an interface velocity V/sub b/ which depends on the He 1 temperature T/sub infinity/. For T/sub infinity/ = 4K, V/sub b/ = 0.1 mm/sec and for T/sub infinity/ = 2.2 K, V/sub B/ = 2 mm/sec. During warm up, He-1 propagated with an interface velocity V/sub b/ > 30 mm/sec that was measured as low bound only. A mathematical model gives a temperature dependent interface thickness in the range 0.0002 approximately equals delta < 0.4 mm. DOE

N80-31672# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.

INVESTIGATION OF THE VIBRATIONAL BEHAVIOR OF A CABLE-STAYED BRIDGE UNDER WIND LOADS

J. W. G. vanNunen and A. J. Persoon 12 Feb. 1979 15 p ref Presented at Intern. Conf. on Environ. Forces on Eng. Struct., London, 3-6 Jul. 1977

(NLR-MP-79004-U) Avail: NTIS HC A02/MF A01

Wind tunnel tests were carried out on a two dimensional model to establish the flutter stability of the bridge and to determine resonance vibrations due to vortex shedding. During construction of the actual bridge, vibration measurements were performed and the wind-induced vibrational behavior of the structure was observed. Measured resonance vibration agreed very well with the values for the model tests in the tunnel. Author (ESA)

N80-31673# National Bureau of Standards, Washington, D.C. Center for Building Technology.

ENERGY BUDGET PROCEDURES AND PERFORMANCE CRITERIA FOR ENERGY CONSERVING BUILDING ILLUMINATION SYSTEMS

Albert T. Hattenburg, Jim L. Heldenbrand, D. K. Ross, R. G. Stein, and W. Taq May 1980 122 p refs

(Contract EA-77-A-01-6010)

(PB80-184229; NBSIR-80-2052) Avail: NTIS HC A06/MF A01 CSCL 13A

Subsystem energy budget development procedures and performance criteria for building illumination were developed by a consultant team of practitioners experienced in building illumination systems. A general procedure is described wherein the energy required for efficient illumination of a building is examined and corresponding power and annual energy budget guidelines are developed. This methodology is applied to three classes of building offices, schools, and residences to illustrate the method. Representative power and energy budgets are developed. GRA

N80-31674# Battelle Columbus Labs., Ohio.

MEASUREMENT AND CORRELATION ANALYSIS PLAN FOR CONCRETE TIE AND FASTENER PERFORMANCE ANALYSIS Interim Report, Oct. - Dec. 1979

F. E. Dean, H. D. Harrison, R. H. Prause, E. T. Selig, and D. McMahon Nov. 1979 206 p refs Prepared in cooperation with Massachusetts Univ., Amherst

(Contract DOT-FR-8164)

(PB80-183882; FRA/ORD-79/51) Avail: NTIS HC A10/MF A01 CSCL 13F

An experiment plan and a correlation methodology through which the long term performance of concrete tie track will be evaluated are presented. The experiment plan defines test segments, instrumentation, and measurement procedures for a comprehensive evaluation, over a two year period, of three concrete tie test sections and one wood tie control section, all of which are installed on revenue service track. This evaluation is to be correlated with similar track performance data from the Faculty for Accelerated Service Testing (FAST). Formats for FAST data to be requested from the Transportation Test Center are summarized. Finally, the methods of direct comparison, regression and analytical simulation, by which track performance at FAST and on the revenue service will be compared, are defined. GRA

N80-31675# National Bureau of Standards, Washington, D.C. Office of International Relations.

NATIONAL BUREAU OF STANDARDS AND AGENCY FOR INTERNATIONAL DEVELOPMENT (NBS/AID) COURSE ON WEIGHTS AND MEASURES SERVICES Final Report

H. Steffen Peiser, ed., Charles C. Raley, ed., Albert D. Tholen, ed., and Penelope M. Odar, ed. Apr. 1980 86 p Course held in Los Angeles, Seattle, and Portland, Oreg., 15-27 Jul. 1979

(Grant PASA-TA(CE)-6-71)

(PB80-187206; NBSIR-80-2022) Avail: NTIS HC A05/MF A01 CSCL 14B

The weights and measures systems of the United States and the role of the National Bureau of Standards was considered so that officials of industrializing nations might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of experience in each of the participant's countries was presented. Countries represented included Egypt, Honduras, India, Liberia, Mexico, Nigeria, Sri Lanka, Sudan, Thailand, and Tunisia. GRA

N80-31676# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.

SEISMIC RESPONSE OF LIGHT ATTACHMENTS TO

BUILDINGS
Roberto Villaverde and Nathan M. Newmark Feb. 1980 442 p refs Sponsored in part by Consejo Nacional de Ciencia y Technologia
(Grants NSF ENV-75-08456; NSF ENV-77-07190)
(PB80-118502B; UILU-ENG-80-7006; Structural-Research-Ser-469; NSF/RA-800035) Avail: NTIS HC A19/MF A01 CSCL 13M

An approximate simple method for predicting the response of secondary systems attached to buildings subjected to earthquakes is presented. Secondary systems comprise a variety of attachments to the floors and walls of large and complex buildings which because of their different characteristic and functions, are not considered part of the structures which support them. The method is based on the premise that interaction between a primary and secondary system can be accounted for by analyzing the interconnected system constructed by such primary and secondary system. The response spectrum method is used to determine the maximum response of the assembled system, and analytical expressions are derived for each step. Comparative studies indicate that this approximate procedure provides a convanient alternative method for the rational seismic design of secondary systems. GRA

N80-31677# Sydney Univ. (Australia). Civil Engineering Labs.
FINITE LAYER ANALYSIS OF CONSOLIDATION, PART 2
J. R. Booker and J. C. Small Nov. 1979 44 p refs
(PB80-182587; R-358-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 13M

The theory developed is extended to apply to the consolidation of horizontally layered soils under both axially symmetric and general surface loading. The method again leads to a considerable reduction in the amount of core storage necessary for computer solution and can be implemented on a minicomputer. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-31678 Pennsylvania Univ., Philadelphia.
AN ANALYSIS OF BURST COMMUNICATION IN TIME DIVISION MULTIPLE ACCESS SYSTEMS Ph.D. Thesis
Christopher Hughes Morton 1980 516 p
Avail: Univ. Microfilms Order No. 8018588

Burst communication performance is quantified through analysis of three fundamental, interrelated aspects of the problem: proper carrier synchronization structures for the burst mode and their statistical performance, the associated structure and error probability performance of the detection circuitry, and the definition of useful measures of burst communication quality. MAP interval estimation theory is used to obtain generalized carrier estimation structures for digitally modulated signals corrupted by passage through a channel exhibiting both linear filtering and nonlinear distortion as well as the presence of Gaussian noise. For M-ary PSK signal sets, special attention is paid to low and high SNR approximations of the optimum structure, their use in the burst mode, and their relationship to supressed carrier tracking loops currently in practical use. Using the method of weighted residuals (Generalized Galerkin Method), an approximate theory of generating both acquisition and steady-state statistics of candidate synchronizers containing N-pole loop filters, is set forth.
Dissert. Abstr.

N80-31679 Drexel Univ., Philadelphia, Pa.
DETECTION OF WEAK SIGNALS IN NON-GAUSSIAN NOISE Ph.D. Thesis
Ning Hsing Lu 1980 222 p
Avail: Univ. Microfilms Order No. 8019355

A class of detectors to test for the presence or absence of weak signals in additive non-Gaussian noise is considered. A locally optimum detector (LOD), is derived in the Neyman-Pearson sense as a model of generalized likelihood ratio under a condition such that the signal is weak compared to the additive noise perturbation. The LOD is comprised of a zero-memory nonlinearity (ZMNL) followed by a matched filter, matched to the signal, or its correlator equivalent. The asymptotic detection performance of the LOD under non-Gaussian, Gaussian, and Cauchy conditions are derived and compared. An adaptive threshold detector (ATD) for the detection of weak signals in additive noise of unknown power level is next discussed. The ATD consists of a LOD, a noise level estimator, and a decision device. The detection threshold is made adaptive according to the information provided by the noise-level estimator in order to keep a fixed false alarm probability. Finally, a suboptimum detector (SOD) and an adaptive detector are proposed for the detection of weak signals in non-Gaussian noise. In contrast to the LOD, the SOD is relatively easy to implement and is shown to perform well for a wide range of underlying noise distributions. Dissert. Abstr.

N80-31680 Missouri Univ. -Rolla.
APPLICATION OF THE CHIRPED Z-TRANSFORM TO PROCESSING FREQUENCY HOPPING SPREAD SPECTRUM SIGNALS Ph.D. Thesis
Sultan Mahmood 1980 175 p
Avail: Univ. Microfilms Order No. 8019014

Charge coupled device/chirped Z transform (CCD/CZT) oriented detection schemes for a frequency-hopped spread spectrum (FHSS) signal in the presence of white Gaussian noise and radio frequency interference are derived. For the case when an FHSS signal is corrupted by white Gaussian noise, the frequency-hopped complex exponents representing a binary symbol are assumed to have partial coherence. The optimum receiver structures are derived from the likelihood ratio for the received waveform samples in the frequency domain. The FH signal itself is divided into time and frequency chips. Signal processing proceeds on a time chip basis. The signal from a time chip is sampled, transformed via the CZT to yield the spectrum in various frequency chips and then correlation is performed. Expressions are derived for the probability of correct detection (P sub D) for both single and double threshold detectors when the FHSS signal is degraded by white Gaussian noise alone and by noise together with jamming. Performance of the detectors is shown in terms of plots of P sub D against various parameters. Dissert. Abstr.

N80-31681 Auburn Univ., Ala.
AN ANALYSIS OF RADOME-INDUCED RADAR POINTING ERROR Ph.D. Thesis
David Gilbert Burks 1980 205 p
Avail: Univ. Microfilms Order No. 8015412

The effect of a tangent ogive radome on the pointing accuracy of a monopulse radar that employs an aperture antenna is analyzed. The radar is assumed to be operating in the receive mode and the incident fields at the antenna are found by a ray tracing procedure. Rays that enter the antenna aperture by direct transmission through the radome and by single reflection from the radome interior are considered. The theory of monopulse radar and the transmission and reflection properties of planar dielectric slabs are presented first to form a background for the radome analysis. Two orthogonal polarization states which can be combined to produce an arbitrarily polarized incident field are considered. The antenna can be scanned in two angular directions and radar pointing error is presented for both these angles as a function of antenna scan angle and polarization of the incident field. A comparison of two different radome wall designs is made in order to both illustrate the analytical techniques and to show the engineering tradeoffs in radome design.
Dissert. Abstr.

N80-31682 British Broadcasting Corp., Kingswood (England). Engineering Div.
CRYSTAL PALACE BAND 2 TESTS: COMPARISON OF TRANSMITTED POLARIZATIONS
J. H. Causebrook Jul. 1980 11 p refs
(BBC-RD-1980/7) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, Engl.

A transmitter was tested, to examine the relative merits of different polarizations for Band 2 fm radio broadcasts. The tests allowed for reception at roof top level, in cars, and on portables.

The relative amounts of multi-path were assessed. It is concluded that in heavily built up areas, as well as in other types of area, there is a significant advantage for car radios and portables in transmitting a vertical component. If this is added to a present horizontally polarised transmission with equal power (3 dB more transmitter power) the effective increase in signal for these receivers is 5 to 7 dB, while stereo reception on fixed horizontal aerials is not significantly affected. R.C.T.

N80-31683 British Broadcasting Corp., Kingswood (England). Engineering Div.

A STUDY OF PEAK MULTIPLEXED SIGNAL LEVEL IN THE CONTEXT OF 2 1/2 OR 3-CHANNEL SURROUND-SOUND TRANSMISSIONS

E. W. Taylor Jul. 1980 17 p refs

(BBC-RD-1980/6) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

The effect on peak multiplexed signal level of quadrature modulating the 38 kHz subcarrier of a pilot tone stereophonic system with the third or T signal of a 2 1/2 or 3 channel system UHJ surround-sound transmission is discussed. Theoretically derived values are compared with measurements made using test material received during independent local radio experimental 2 1/2 channel system UHJ transmissions. The conditions under which measurements of peak baseband signal level give a realistic indication of peak multiplexed signal level are described. Author

N80-31684*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A SIMPLE STRIPLINE DESIGN FOR UNEVEN POWER SPLIT

M. C. Bailey Aug. 1980 10 p

(NASA-TM-81870) Avail: NTIS HC A02/MF A01 CSCL 09C

A technique for the design of stripline or microstrip power dividers for unequal, but in-phase, power split is described. The output power ratio is determined by selecting the location of the input port in a manner analogous to the tap point for an electric power transformer. The technique yields a usable bandwidth of 7 to 8 percent and is attractive for tapered amplitude distribution networks for narrow band phased arrays. S.F.

N80-31685*# Arinc Research Corp., Annapolis, Md.

VIDEO DISTRIBUTION SYSTEM COST MODEL Final Report

I. Gershkoff, J. Kent Haspert, and B. Morgenstern Jul. 1980 225 p

(Contract NAS5-25401)

(NASA-CR-160020; Publ-1358-01-3-2238) Avail: NTIS HC A10/MF A01 CSCL 17B

A cost model that can be used to systematically identify the costs of procuring and operating satellite linked communications systems is described. The user defines a network configuration by specifying the location of each participating site, the interconnection requirements, and the transmission paths available for the uplink (studio to satellite), downlink (satellite to audience), and voice talkback (between audience and studio) segments of the network. The model uses this information to calculate the least expensive signal distribution path for each participating site. Cost estimates are broken downy by capital, installation, lease, operations and maintenance. The design of the model permits flexibility in specifying network and cost structure. T.M.

N80-31686# Institute for Telecommunication Sciences, Boulder, Colo.

VOICE PERFORMANCE MEASUREMENTS Final Report

W. J. Hartman and L. E. Pratt Jun. 1980 26 p refs

(Contract DOT-FA79WAI-013)

(AD-A087108; FAA-RD-80-71) Avail: NTIS HC A03/MF A01 CSCL 09/4

Subjective intelligibility scores are determined for various combinations of signal-to-noise ratios, clipping, filtering, and pre-emphasis/de-emphasis. These are compared with scores derived using linear predictive coding (LPC). An overall correlation of 0.88 is obtained between the two sets of scores. GRA

N80-31687# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Fleet Systems Dept.

MOVING TARGET DETECTOR DATA UTILIZATION INVESTIGATION Data Analysis Report, 1975 - 1976

F. R. Castella, M. J. Feil, J. T. Miller, and C. L. Roe Mar. 1980 141 p refs

(Contract DOT-FA74WA-3423)

(AD-A088962; JHU/APL/FPS-T-041; FAA-RD80-29) Avail: NTIS HC A07/MF A01 CSCL 17/9

The Moving Target Detector (MTD), developed by MIT's Lincoln Lab., under contract to the Federal Aviation Administration (FAA), was designed as an improved video processor for use with the Airport Surveillance Radars within the Automated Radar Terminal System (ARTS) 3 automated Air Traffic Control (ATC) system. This device interfaces between the analog radar system and the digital automatic tracking system to provide automatic target detection and false alarm regulation. In addition to range, bearing, and amplitude data, the MTD provides Doppler information on detected targets. This data is in the form of unconsolidated reports that are to be centroided and tracked to provide a primary radar data base for ATC functions. In order to evaluate the potential benefits of this MTD data on the ATC tracking operation, the present study was conducted using experimental data gathered by the FAA and Lincoln Laboratory with an FPS-18 radar at the National Aviation Facilities Engineering Center during the summer of 1975. The principal investigations focus on: development of a centroid algorithm for extracting significant target features; and using these features within the subsequent tracking function. GRA

N80-31688# McDonnell-Douglas Research Labs., St. Louis, Mo.

RADIATION AND SCATTERING FROM BODIES OF TRANSLATION, VOLUME 1 Final Technical Report, 26 Sep. 1977 - 26 Jul. 1979

L. N. Medgyesi-Mitschang Griffiss AFB, N.Y. RADC Apr. 1980 67 p refs 3 Vol.

(Contract F30602-77-C-0233; AF Proj. 2338)

(AD-A087402; RADC-TR-80-142-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 20/14

An analytical formulation, based on the method of moments (MM) is described for solving electromagnetic problems associated with finite-length cylinders of arbitrary cross section, denoted in this report as bodies of translation (BOT). This class of bodies can be used to model structures with noncircular cross sections such as wings, fins, and aircraft fuselages. The theoretical development parallels in part the MM formulation developed earlier by Mautz and Harrington for bodies of revolution (BOR). Like the latter approach, a modal expansion is used to describe the unknown surface currents on the BOT. The present analysis has been developed to treat the far-field radiation and scattering from a BOT excited by active antennas or illuminated by a plane wave of arbitrary polarization and angle of incidence. In addition, the electric and magnetic near-field components are determined in the vicinity of active and passive apertures (slots). Using the Schelkunoff equivalence theorem, the aperture-coupled fields within a BOT are also obtained. The formulation has been implemented by a computer algorithm and validated using accepted data in the literature. GRA

N80-31689# McDonnell-Douglas Research Labs., St. Louis, Mo.

RADIATION AND SCATTERING FROM BODIES OF TRANSLATION, VOLUME 2: USER'S MANUAL, COMPUTER PROGRAM DOCUMENTATION Final Technical Report, 26 Sep. 1977 - 26 Jul. 1979

L. N. Medgyesi-Mitschang and J. M. Putnam Griffiss AFB, N.Y. RADC Apr. 1980 126 p 3 Vol.

(Contract F30602-77-C-0233; AF Proj. 2338)

(AD-A087403; RADC-TR-80-142-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/14

A hierarchy of computer programs implementing the method of moments for bodies of translation (MM/BOT) is described. The algorithm treats the far-field radiation and scattering from finite-length open cylinders of arbitrary cross section as well as the near fields and aperture-coupled fields for rectangular apertures on such bodies. The theoretical development underlying the algorithm is described in Volume 1. The structure of the computer algorithm is such that no a priori knowledge of the method of moments technique or detailed FORTRAN experience are

presupposed for the user. A set of carefully drawn example problems illustrates all the options of the algorithm. For more detailed understanding of the workings of the codes, special cross referencing to the equations in Volume 1 is provided. For additional clarity, comment statements are liberally interspersed in the code listings, summarized in the present volume. GRA

N80-31690# Naval Ocean Systems Center, San Diego, Calif. EM Propagation Div.

EQUATORIAL SCINTILLATION OF SATELLITE SIGNALS AT UHF AND L-BAND FOR TWO DIFFERENT ELEVATION ANGLES Technical Report, 1 Jan. 1979 - May 1980

M. R. Paulson 1 May 1980 185 p refs (RR0320801)
(AD-A087404; NOSC/TR-543) Avail: NTIS HC A09/MF A01 CSCL 20/14

An investigation of the equatorial scintillation of satellite signals at uhf and L-band for 10 and 50 degree elevation angles is reported. Diurnal and seasonal variations of scintillation, as well as solar cycle dependence, are given. The occurrence and intensity of scintillations are compared for the two frequencies and for the two elevation angles. A number of fade duration distributions for fades greater than 6 and greater than 12 dB below the undisturbed signal are shown for each frequency and each satellite. A periodicity in the occurrence of scintillation is reported and is attributed to the gravitation field of the Moon. It is proposed that the Moon's gravity affects the occurrence and intensity of equatorial scintillation by modulating the velocity of the zonal winds at ionospheric heights. GRA

N80-31691# Parke Mathematical Labs., Inc., Carlisle, Mass.

GROUND RANGE AND BEARING ERROR DETERMINATION AND DISPLAY FOR AN OTH RADAR SYSTEM WITH AN ARCTIC TROUGH IONOSPHERE Final Report, Oct. 1978 - Oct. 1979

Dean Bandes and Theodore B. Barrett Hanscom AFB, Mass. AFGL Feb. 1980 52 p refs
(Contract F19628-76-C-0296; AF Proj. 7663)
(AD-A087010; Rept-0296-FR-2-Pt-2; AFGL-TR-80-0055-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report describes the algorithms used to determine range and bearing errors which might be incurred in an OTH radar system where the propagating medium includes an arctic trough. Several types of plots for displaying this error information are described along with an example. GRA

N80-31692# Naval Research Lab., Washington, D. C. Advanced Systems Branch.

RADAR EMI AT SEA Interim Report

Louis J. Lavedan 28 Jan. 1980 21 p refs
(AD-A087213; AD-E000449; NRL-MR-4082) Avail: NTIS HC A02/MF A01 CSCL 17/9

As quantity and complexity of electronic systems on Navy ships increase, so does the probability of rf interference between systems, even those located on separate ships. This report briefly describes the coupling mechanisms possible between 200 MHz and 4000 MHz and supplies data in the form of graphs and describes a method whereby the magnitude of the interference can be quickly calculated for the various sea environments. GRA

N80-31693# Network Analysis Corp., Great Neck, N. Y.

PACKET RADIO DEPLOYMENT STUDY

10 Apr. 1980 193 p refs
(Contract DAAK80-79-C-0763)
(AD-A087417; FR-207-01-R1) Avail: NTIS HC A09/MF A01 CSCL 17/2

This report documents the results of the Packet Radio Deployment Study whose objective is to assess the potential of the Packet Radio technology for satisfying communications requirements in the military environment. The focus of this study has been on the following three tasks: enhancement of the packet radio simulation program (PRSIM); implementation of a military scenario model; and design, routing and performance analysis of packet radio networks for the military scenarios. GRA

N80-31694# Army Electronics Research and Development Command, Fort Belvoir, Va. Night Vision and Electro-Optics Labs.

MEASUREMENTS OF MILLIMETER WAVE RADAR TRANSMISSION AND BACKSCATTER DURING DUSTY INFRARED TEST 2, DIRT 2 Final Report

F. C. Petito and E. W. Wentworth May 1980 40 p
(DA Proj. 1E2-63710-DK-70)
(AD-A086189; DELNV-TR-0011) Avail: NTIS HC A03/MF A01 CSCL 17/9

Recently there has been much interest expressed to determine the ability of millimeter wave radar to perform target acquisition during degraded visibility conditions. In this regard, one of the primary issues of concern has been the potential of high-explosive artillery barrages to obscure the battlefield from millimeter wave radar systems. To address this issue 95 GHz millimeter wave radar measurements were conducted during the Dusty Infrared Test 2 (DIRT 2). This test was held at White Sands Missile Range, NM, 18-28 July 1979. Millimeter wave transmission and backscatter measurements were performed during singular live firings and static detonations of 155 mm and 105 mm high-explosive artillery rounds in addition to static detonations of C-4 explosives. A brief description of the millimeter wave portion of the test and instrumentation is given. The data along with some preliminary conclusions are presented. GRA

N80-31695# Defense Communications Engineering Office, Reston, Va. Transmission Engineering Div.

ASSESSMENT OF FREQUENCY SELECTIVE FADING ON DCS TRANSMISSION SYSTEM PERFORMANCE.

David R. Smith and John L. Osterholz Aug. 1979 56 p refs
(AD-A087794; AD-E100356; DCEC-EP-5-79; Rept-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

Recent reassessments of digital LOS transmission systems indicate that transmission is affected by more than power fading alone. Tests showed that extensive inband amplitude and phase distortion occur during even relatively shallow fades. To facilitate the study of these phenomena, a hybrid computer simulation of the AN/FRC-DCS Digital Radio was developed, and is described in this EP. GRA

N80-31696# Defense Communications Engineering Office, Reston, Va. Transmission Engineering Div.

PROCEEDINGS OF SEMINAR ON FREQUENCY SELECTIVE FADING AND ITS EFFECT ON DIGITAL LOS RADIO

David R. Smith, ed. Jan. 1980 248 p refs Conf. held at Reston, Va., 26 Nov. 1979
(AD-A087793; AD-E100375; DCEC-TN-2-80; Rept-2) Avail: NTIS HC A11/MF A01 CSCL 17/2

Recent analysis and testing of digital LOS radio links reported in the literature indicate that frequency selective fading may be responsible for performance degradation in the form of inband amplitude and phase distortion. To facilitate an exchange of information among interested groups from government and industry, a seminar was organized by and held at DCEC on the subject of frequency selective fading and its effects on digital LOS radio. This TN presents the proceedings of that seminar. GRA

N80-31697# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

DYNAMIC BEHAVIOR OF SHORTEST PATH ROUTING ALGORITHMS FOR COMMUNICATION NETWORKS

Dimitri P. Bertsekas Jun. 1980 56 p refs
(Contracts N00014-75-C-1183; MDA903-78-C-0129; Grant NSF ENG-77-15949)
(AD-A087706; LIDS-TH-1005) Avail: NTIS HC A04/MF A01 CSCL 17/2

Several proposed routing algorithms for store and forward communication networks, including one currently in operation in the ARPANET, route messages along shortest paths computed by using some set of link lengths. When these lengths depend on current traffic conditions as they must in an adaptive algorithm, dynamic behavior questions such as stability convergence, and speed of convergence are of interest. This paper is the first attempt to analyze systematically these issues. It is shown that minimum queuing delay path algorithms tend to exhibit violent oscillatory behavior in the absence of a damping mechanism. The oscillations can be damped by means of several types of schemes, two of which are analyzed in this paper. In the first scheme a constant bias is added to the queuing delay

thereby providing a preference towards paths with a small number of links. In the second scheme the effects of several past routings are averaged as, for example, when the link lengths are computed and communicated asynchronously throughout the network. GRA

N80-31699# Sperry Gyroscope Co., Great Neck, N. Y.
COLUMN NETWORK STUDY FOR A PLANAR ARRAY USED WITH AN UNATTENDED RADAR Final Technical Report
Gerald L. Hanley and Harry R. Perini Jun. 1980 65 p
(Contract F19628-78-C-0166; AF Proj. 2448)
(AD-A087809; SG-4253-1182; RADC-TR-80-191) Avail: NTIS HC A04/MF A01 CSCL 17/9

Objectives of this program are to investigate design and fabrication techniques for an azimuthally phase-steerable planar array with dual beams for elevation coverage. Network costs, network insertion loss, antenna pattern performance, and reliability are significant considerations. A stripline dual beam column network is being designed, fabricated and tested to demonstrate achievable performance and competitive techniques for production and installation costs are being studied. This report summarizes the work completed during the program: completion of the antenna conceptual design, development of all the required components, design of the dual beam column network, and results of competitive techniques for production. GRA

N80-31698# Airborne Instruments Lab., Melville, N. Y.
MICROWAVE TRANSVERSAL EQUALIZER Final Technical Report, 1 Nov. 1978 - 30 Nov. 1979
J. Wolczok and G. Kanischak Griffiss AFB, N.Y. RADC May 1980 48 p refs
(Contract F30602-78-C-0352; AF Proj. 4506)
(AD-A087603; RADC-TR-80-121) Avail: NTIS HC A03/MF A01 CSCL 09/5

A Microwave Transversal Equalizer has been designed, fabricated, and installed at RADC and is capable of reducing side-lobe distortion levels of -18 dBm to less than -35 dBm. The MTE operates in the 3.0 to 3.5 GHz frequency range. GRA

N80-31700# Army Materiel Development and Readiness Command, Adelphi, Md. Countermeasures/Counter-Countermeasures Office.
PSEUDONOISE SPREAD-SPRETRUM SYSTEMS FOR MILITARY COMMUNICATIONS
Don J. Torrieri Dec. 1979 27 p refs
(DA Proj. 1S2-63749-D-462)
(AD-A087701; CM/CCM-79-9) Avail: NTIS HC A03/MF A01 CSCL 17/2

The basic characteristics of various pseudonoise spread-spectrum systems are discussed with emphasis on direct-sequence modulation. A necessary condition is derived for the concealment of a pseudonoise waveform from detection. The condition establishes a lower bound for the pseudonoise code length. The bit error probability in the presence of various types of interference is determined. It is shown that if the total bandwidth and the word duration are fixed, the potential improvement in performance due to error-correction coding is partially counterbalanced by the resulting decrease in processing gain. Methods of reducing the mutual interference in a network of pseudonoise systems are examined. Jamming strategies, acquisition techniques, and hybrid frequency-hopping pseudonoise systems are discussed. Differences in the error rate performance between frequency-hopping systems and pseudonoise systems are illustrated. GRA

N80-31701# Illinois Univ. at Urbana-Champaign, Urbana. Electromagnetics Lab.
EVALUATION OF LOSSES IN MICROSTRIP ANTENNA MATERIALS Interim Report
Y. T. Lo, W. F. Richards, and J. E. Brewer Griffiss AFB, N.Y. RADC Apr. 1980 60 p refs
(Contract F19628-78-C-0025; AF Proj. 2305)
(AD-A087476; RADC-TR-80-85; IR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

A microstrip antenna consists of a conducting patch etched on a dielectric substrate over a ground plane. To evaluate the antenna efficiency, one must know the losses in the material. The dielectric loss is specified by its loss tangent and the copper by its conductivity (or equivalently by its skin-depth at a given frequency). Usually, they can be determined separately with well-known experimental procedures. However, for the copper-cladded material used in microstrip antennas, the surfaces of both the dielectric slab and copper (2D) plates are deliberately roughened and filled with bonding agent in-between for mechanical strength. In this case, the separate measurements for the two materials become meaningless. Many measurements were conducted in this manner, and in most cases good consistent results were obtained. The loss parameters so determined resulted in theoretically computed antenna impedance characteristics in nearly perfect agreement with the measured results. However, the inconsistency in a few other cases suggests that there may be a significant amount of inhomogeneity in the manufacturing process in the material from one part to the other, or from batch to batch. GRA

N80-31702# Michigan Univ., Ann Arbor. Radiation Lab.
A THEORETICAL STUDY OF DIELECTRIC-FILLED EDGE-SLOT ANTENNAS Final Report, 1 Jun. 1979 - 31 May 1980
Dipak L. Sengupta Jul. 1980 7 p refs
(Contract DAAG29-79-C-0096)
(AD-A087482; ARO-14808.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

A theory has been developed for the dielectric filled edge slot (DFES) antennas. It clearly brings out the effects of various parameters on the performance of the antenna, and can be used for the design of such antennas under a variety of conditions. In addition to the theory of DFES antennas, the following accomplishments were realized: (a) the equivalent circuit of DFES antennas and (b) the equivalent parameters for the tuning posts in a radial waveguide. The techniques used and the results obtained may be applied to other antennas, e.g., to probe-fed patch antennas tuned by metallic posts. GRA

N80-31703# Queens Univ., Kingston (Ontario).
PERFORMANCE CHARACTERISTICS OF LEAKY COAXIAL CABLES Final Technical Report, Nov. 1977 - Jun. 1979
James L. Mason Griffiss AFB, N.Y. RADC Apr. 1980 171 p refs
(Contract F19628-77-C-0249; AF Proj. 4600)
(AD-A087475; RADC-TR-79-340) Avail: NTIS HC A08/MF A01 CSCL 17/9

This work deals with guided radar and reports on the experiments and analysis that were performed to obtain information on the function of leaky coaxial cables used as radio frequency intrusion sensors. Four subjects were investigated: (1) environmental effects on the leaky coaxial cable and the guided radar system, (2) use of Doppler shift caused by an intruder to determine the velocity and direction of the intruder, (3) target identification, classification and signature, and (4) a single leaky coaxial cable intrusion detection system. The most important environmental factor was moisture, either rain or snow. Results have demonstrated that the velocity of a target moving longitudinally between the leaky cable sensors can be measured, based on the Doppler shift in the return signal. Rudimentary target classification has been demonstrated based on a defined target signature--the log-magnitude of the Fourier transform of the target vector. A single cable intrusion detection system was investigated which incorporated a modulation technique which allowed the intruder to be located. GRA

N80-31704# University of Southern California, Los Angeles. Image Processing Inst.
HIGH RESOLUTION DIGITAL RADAR IMAGING OF ROTATING OBJECTS Ph.D. Thesis
Yeh-Hua Peter Chuan Jun. 1980 269 p refs
(Contract F33615-76-C-1203; DARPA Order 3119)
(AD-A087510; USCIPI-970) Avail: NTIS HC A12/MF A01 CSCL 17/9

This dissertation is devoted to the imaging aspect of the problem of obtaining high resolution images of practical radar targets with digital processing techniques. The motion compensation aspect of the problem is also briefly described. A multi-frequency stepped (MFS) radar is assumed and the Fourier transform relationship between the data (dimensioned in aspect angle and signal frequency) and the target reflectivity function is derived in both 2-D and 3-D forms. Assuming that the data

is available for 360 deg aspect angle and using wideband radar, a coherent digital processing method is developed which will give the best possible resolution. Such a situation occurs when the target makes a complete turn. It is found that for such an imaging system the resolution is inversely proportional to the mean carrier frequency if such frequency is large compared to the signal bandwidth. In the case when the data is undersampled in range or aspect angle or both, a modified coherent digital signal processing technique is described that will get around such difficulty. It is found that the modified processing method gives poorer resolution but is better than either the mixed processing method or the incoherent processing method. The latter two processing techniques are also described in this dissertation. Experimental results are also presented and problems with real targets such as shadowing, glint, and scintillation are discussed. GRA

N80-31705# Los Alamos Scientific Lab., N. Mex. Computer Div.
WAVE PROPAGATION IN A dc SUPERCONDUCTING CABLE. PART 1: ANALYSIS
Pritindra Chowdhuri and Mary-Anne Mahaffy 1980 9 p refs Presented at the IEEE PES Summer Meeting, Minneapolis, Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-125; CONF-800722-1) Avail: NTIS HC A02/MF A01

A dc superconducting cable design consisting of four concentric metallic cylinders, of which two carry the load current and two comprise the cryogenic enclosure, is considered. When a transient voltage is impressed across such a cable, the major dielectric may not be fully stressed to its design value, and unwanted voltage stresses may develop across other parts of the cable. The surge voltage propagation characteristics of a four conductor dc superconducting cable for a step function input voltage is analyzed. This analysis, although mainly directed to superconducting cables, is also applicable to other multiconductor transmission lines. DOE

N80-31706# Los Alamos Scientific Lab., N. Mex.
WAVE PROPAGATION IN A dc SUPERCONDUCTING CABLE. PART 2: PARAMETRIC EFFECTS
P. Chowdhuri and M. Mahaffy 1980 9 p refs Presented at IEEE PES Summer Meeting, Minneapolis, Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-126; CONF-800722-2) Avail: NTIS HC A02/MF A01

Wave propagation in several designs, of dc superconducting cables are studied. The dc conventional cables are also included for the purpose of comparison. For a multiconductor cable system, undesirable transient voltages may develop across parts that are not designed to withstand high voltages. The effects of several parameters such as voltage rating, number of conductors, conductor resistances, Earth resistivity, terminal grounding resistances of the grounded conductors at the origin and dielectric constants were studied. Voltage rating, conductor resistances, and terminal grounding resistances seem to influence the transient performance of a multiconductor cable significantly. The effect of finite Earth resistivity is insignificant. DOE

N80-31707# Los Alamos Scientific Lab., N. Mex.
DYMAC COMMUNICATIONS SYSTEM
Kathleen A. Lindsey Jan. 1980 130 p
(Contract W-7405-eng-36)
(LA-8182-M) Avail: NTIS HC A01/MF A01

The DYMAC Communications System is part of a nuclear safeguard system called DYMAC - short for DYnamic Materials ACcountability -that gathers accountability information at the Los Alamos Scientific Laboratory (LASL) Plutonium Processing Facility. The communications system handles transmissions between data entry terminals and nondestructive assay instruments located in the facility, and a computer located in a adjacent building. The components that make up the communication network are described including how they operate, and detailed information about all of the connections. Circuit diagrams for all the LASL modifications and LASL fabricated equipment are provided. In addition, a series of procedures are described for tracing cables, reconfiguring various parts of the system, testing data transmissions, and troubleshooting malfunctions. DOE

N80-31708# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY ASSESSMENT OF THE ELECTROMAGNETIC ENVIRONMENT IN THE IMMEDIATE VICINITY OF THE ETA ACCELERATOR
H. S. Cabayan, E. Bogdan, J. Zicker, D. Wythe, and G. J. Burke Apr. 1980 116 p refs
(Contract W-7405-eng-48)
(UCID-18631) Avail: NTIS HC A06/MF A01

The electromagnetic fields in the immediate vicinity of the Experimental Test Accelerator (ETA) at the Lawrence Livermore Laboratory were characterized. Various EM sensors that cover the frequency band from the very low frequencies up into the GHz region were used. The probes, the test set up and the data processing techniques are described. DOE

N80-31709# Centre National d'Etudes Spatiales, Toulouse (France).
RESIDUAL ERROR OF DUAL-FREQUENCY SPATIAL RADIO TRACKING SYSTEMS DUE TO THE IONOSPHERE [ERREUR IONOSPHERIQUE RESIDUELLE DANS LES SYSTEMES DE RADIOLOCALISATION SPATIALE BIFREQUENCES]
Jean Saint-Etienne Jan. 1980 48 p refs In FRENCH; ENGLISH summary Presented at CNEXO Colloq., Brest, France 1-5 Oct. 1979
(CNES-NT-93) Avail: NTIS HC A03/MF A01

Errors due to ionospheric interference in navigation and geodetic satellite systems are discussed. The raw error without correction is indicated. The possibility of correction by the use of ionospheric models is briefly considered. More details concerning a method of correction which uses an additional link operating at a frequency well separated from that of the main link, taking into account the dispersive property of the ionosphere, are given. Correction by dual frequency measurement is then formalized. Results are applied to the case of range measurements involving group propagation velocity and to the case of range rate measurements (Doppler effect) involving phase propagation velocity. Author (ESA)

N80-31710# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France). Dept. PCE.
ANALYSIS OF ELECTROMAGNETIC WAVE FIELD FROM MODELS WITH ONE OR TWO PRIVILEGED DIRECTIONS [ANALYSE DE CHAMPS D'ONDES ELECTROMAGNETIQUES A PARTIR DE MODELES A UNE OU DEUX DIRECTIONS PRIVILEGES]
L. J. Buchalet Sep. 1979 52 p refs In FRENCH Sponsored in part by Delegation Gen. a la Rech. Sci. et Tech. (DGRST)
(CRPE-NT-76) Avail: NTIS HC A04/MF A01

A method was developed to analyze the measurements of an electromagnetic wave field in a spatial magnetoplasma. The definition of the wave distribution function is first recalled. The technique is explained for obtaining the spectral matrix (measured without noise). The methods for calculating the parameters are presented. The study was then repeated in the presence of noise and the differences noted. The models with one or two privileged directions are studied. The analysis of real data, from the Omega emitter and collected through a GEOS satellite, is then presented. Author (ESA)

N80-31711# Fondazione Ugo Bordoni, Rome (Italy).
[ACTIVITIES IN THE FIELD OF COMMUNICATIONS IN ITALY, 1978] Annual Report [RELAZIONE SULL'ATTIVITA DI COLLABORAZIONE CON L'ISTITUTO SUPERIORE POSTE E TELECOMUNCAZIONE SVOLTA DALLA FONDAZIONE UGO BORDONI NEL 1978]
Renato Koch Feb. 1979 50 p refs In ITALIAN
Avail: NTIS HC A03/MF A01

The 1978 research activities are summarized covering radio communication systems, cable communication systems and digital sytems, automatic systems in communications, management and control, and laser systems and optoelectronics. Author (ESA)

N80-31712# Fondazione Ugo Bordoni, Rome (Italy).
THE POSSIBILITY OF UTILIZING CODING TECHNIQUES

TO IMPROVE THE AVAILABILITY OF DIGITAL RADIO LINK NETWORKS AT FREQUENCIES OVER 10 GHz [POSSIBILITA' DI IMPIEGO DI TECHNICHE DI CODIFICA PER MIGLIORARE LA DISPONIBILITA' DI RETE IN PONTI RADIO NUMERICI A FREQUENZE SUPERIORI A 10 GHz]

Angelo Bernardini (Rome Univ.), Paolo Mandarini (Rome Univ.), and Gianfranco Meucci (Rome Univ.) Dec. 1978 20 p refs In ITALIAN

(FUB-54-1978) Avail: NTIS HC A02/MF A01

An optimal solution of the number of available circuits as a function of the out-of-service probability by using couples of channel co-decoders at the extremities of the radio link is developed. The conclusions are extended to suboptimal solutions with different degrees of redundancy. The evaluation of hop length in the absence of the co-decoding method is presented.

Author (ESA)

N80-31713# Fondazione Ugo Bordoni, Rome (Italy).

APPLICATIONS OF THE FINITE ELEMENT METHOD TO THE CALCULATION OF ELECTROMAGNETIC FIELDS IN CYLINDRICAL STRUCTURES [APPLICAZIONE DEL METODO DEGLI ELEMENTI FINITI AL CALCOLO DEL CAMPO ELETTROMAGNETICO IN STRUCTTURE CILINDRICHE]

E. Carli (Trieste Univ.), T. Corzani (Trieste Univ.), L. Mania (Trieste Univ.), and E. Valentinuzzi (Trieste Univ.) Mar. 1979 49 p refs In ITALIAN

(FUB-2-1979) Avail: NTIS HC A03/MF A01

The finite element method is adapted to open structures where surface waves can propagate. Applications are considered in conventional areas such as microwave circuits and antenna or less conventional subjects such as traffic control. The proposed computer program is described and numerical results are given. The computer memory requirements and the limitations regarding surface wave applications are discussed. Author (ESA)

N80-31714# Fondazione Ugo Bordoni, Rome (Italy).

QUANTIZATION NOISE SPECTRA CALCULATION [CALCOLO DELLO SPETTRO DEL RUMORE DI QUANTIZZAZIONE]

Alberto Fiocco (Ancona Univ., Italy), Luigi Giacomelli (Ancona Univ., Italy), Renato Lucarelli, and Aldo Roveri (Rome Univ.) Jun. 1979 20 p refs In ITALIAN

(FUB-5-1979) Avail: NTIS HC A02/MF A01

The quantization noise power density spectrum calculation is studied and a discussion of the quantization noise definition presented. The application of the developed formulas allows the computation of the bilateral noise spectra as a function of the normalized frequency both for uniform and non-uniform quantization. Numerical examples are given in chart form. Author (ESA)

N80-31715# Fondazione Ugo Bordoni, Rome (Italy).

PROPAGATION IN DIELECTRIC GUIDES [PROPAGAZIONE IN GUIDE DIELECTTRICHE]

Paolo DiPorto Jun. 1979 21 p refs In ITALIAN

(FUB-6-1979) Avail: NTIS HC A02/MF A01

The theory of electromagnetic wave propagation in optical fibers is reviewed. Equations for step-index and graded-index fibers are developed. The numerical aperture, mode delay, impulse response, chromatic and modal dispersion, and other concepts related to fiber optics are examined. Author (ESA)

N80-31716# Fondazione Ugo Bordoni, Rome (Italy).

CUSTOMER ACCESS PROTOCOLS TO INTEGRATED SERVICES DIGITAL NETWORKS

Nicola Accarino, Maurizio Decina (Istituto di Comunicazioni Elettriche, Rome), Claudio Rossi, and Aldo Roveri (Istituto di Communicazioni Elettriche, Rome) Jun. 1979 11 p refs Presented at 27th Intern. Conv. on Commun., Genoa, Oct. 1979

(FUB-7-1979) Avail: NTIS HC A02/MF A01

Trends in the conception of local digital networks offering a variety of services including data and telephony are presented, and the interaction between customer access protocols and network architectures discussed. The basic features of a customer-to-network signalling scheme are presented which allow the full treatment of circuit-switched data calls at 64 kbit/s by the Pulse Code Modulation (PCM) local and trunk exchanges and the processing of packet switched data calls by specialized network nodes accessed on demand via the PCM facilities.

Author (ESA)

N80-31717# Fondazione Ugo Bordoni, Rome (Italy).

SOME PROPERTIES OF THE PARTIAL RESPONSE CODES OF AN ORDER GREATER THAN TWO [SU ALCUNE PROPRIETA' DEI CODICI PARTIAL RESPONSE DI ORDINE SUPERIORE AL BINARIO]

Giuseppe Maria Poscetti (Rome Univ.) Jun. 1979 36 p refs In ITALIAN

(FUB-9-1979) Avail: NTIS HC A03/MF A01

An analysis of the cases for which precoding of a generalized order is possible is presented, and the properties of the digital sum, used in limited digital sum codes, are studied for orders greater than two. It is concluded that a high number of levels in the codified message are usually found when using codes of a higher order, for which the studied cases are not expected to have immediate application. Author (ESA)

N80-31718# Fondazione Ugo Bordoni, Rome (Italy).

PROCEDURES FOR OUT-OF-SERVICE VERIFICATION AND HOP LENGTH DIMENSIONING IN NUMERICAL RADIO LINKS [PROCEDIMENTI DI VERIFICA DI FUORI SERVIZIO E DI DIMENSIONAMENTO DI TRATTRA IN PONTI RADIO NUMERICI]

Angelo Bernardini (Rome Univ.), Paolo Mandarini (Rome Univ.), and Gianfranco Meucci (Rome Univ.) Jun. 1979 77 p refs In ITALIAN

(FUB-10-1979) Avail: NTIS HC A05/MF A01

General procedures for out of service verification in a 2500 km radio link in the presence of propagation anomalies due to rain of multipath are studied. It is shown that the out of service situation may be verified if the out of service probability function is known, and this function is examined for the cases of cross polarization attenuation and of uniform attenuation and depolarization. A FORTRAN program was written to perform the estimation. The out of service verification in the presence of selective attenuation due to multiple path and depolarization is discussed, including the evaluation of the space diversity effects on the out of service probability. Author (ESA)

N80-31719# Fondazione Ugo Bordoni, Rome (Italy).

DEVELOPMENT OF COST 202 PROJECT: NUMERICAL LOCAL NETWORKS FOR TELECOMMUNICATIONS [STATO DI SVILUPPO DEL PROGETTO COST 202: RETI LOCALI NUMERICHE PER TELECOMUNICAZIONI]

Nicola Accarino, Maurizio Decina (Istituto di Comunicazioni Elettriche, Rome), Roberto Montemuro, Claudio Rossi, and Francesco Villani Jun. 1979 9 p refs In ITALIAN

(FUB-14-1979) Avail: NTIS HC A02/MF A01

The COST 202 project is defined as a three-year research project studying digital techniques employable within the next 30 years in local networks. The participation of several European nations is mentioned. The main areas of the project which were agreed upon, are the evolution of local networks, signalization in local networks, and transmission on existing lines. The preliminary research activities undertaken by the Italian group are detailed, including 64 kbits numerical telephony, new services in circuit or packet switching up to 64 kbit/s telemetry, access to local networks, transmission interfaces, and terminal architecture. Author (ESA)

N80-31720# Fondazione Ugo Bordoni, Rome (Italy).

CAPACITY OPTIMIZATION OF A RESERVE NETWORK USED FOR REROUTING DAMAGED SERVICE BLOCKS [OTTIMIZZAZIONE DELLE CAPACITA' DI UNA RETE DI RISERVA IMPIEGATA PER IL REISTRADAMENTO DEI BLOCCHI DI ESERCIZIO IN AVARIA]

Gastone Bonaventura (Stato dei Servizi Telefonici), Ugo Mocci, and Giacomo Ravaioli May 1979 10 p refs In ITALIAN Presented at 27th Intern. Conv. on Commun., Genoa, 9-12 Oct. 1979

(FUB-18-1979) Avail: NTIS HC A02/MF A01

The use of a standby network is an effective method for the rerouting of groups of circuits when a fault occurs on a transmission medium in a long distance network. Two problems are considered: to find a minimum cost standby network able

to reroute all the interrupted groups, at least when only one block at a time is defective; and to find the largest part of the in-service network that can still be protected meeting a prescribed bound on the cost of the standby network. The influences of different choices of rerouting criteria and of network structure are examined using a computer program. Author (ESA)

N80-31721# Fondazione Ugo Bordoni, Rome (Italy).
A PROCEDURE FOR SATISFYING IN AN OPTIMAL WAY TIME VARYING CIRCUIT REQUIREMENTS [UNA PROCEDURA PER IL SODDISFACIMENTO OTTIMO DI RICHIESTE DI CIRCUITI VARIABILI NEL TEMPO]
Francesco Mazzarella, Ugo Mocci, Giacomo Ravaioli, and Sandra Spedaletti May 1979 9 p refs In ITALIAN Presented at 27th Intern. Conv. on Commun., Genoa, 9-12 Oct. 1979
(FUB-19-1979) Avail: NTIS HC A02/MF A01

The problem of satisfying at minimum cost, time-varying circuit requirements between centers of a telecommunication network is considered. The overall procedure works in two phases. In the first, one of the requirements are routed through the network, and the circuit number of each link is computed. In the second phase, an optimal plan of installation is determined. The procedure was implemented with a computer program. Author (ESA)

N80-31722# Fondazione Ugo Bordoni, Rome (Italy).
INFLUENCE OF THE SPACE STRUCTURE AND PHYSICAL PROPERTIES OF RAIN ON THE EVALUATION OF THE ANISOTROPY AND DEPOLARIZING PROPERTIES [INFLUENZA DELLA STRUTTURA SPAZIALE E DELLE PROPRIETA' FISICHE DELLE PRECIPITATIONI SUFLA VALUTAZIONE DELLA ANISOPTROPIA E DELLA PROPRIETA'S DEPOLARIZZANTI]
Dario Maggiori (Politecnico di Milan) and Aldo Paraboni Dec. 1979 37 p refs In ITALIAN
(FUB-22-1979) Avail: NTIS HC A03/MF A01

The anisotropy and polarization of centimeter waves propagating through rain was studied as a function of meteorological parameters such as the drop diameter distribution, the drop temperature, the rain intensity profile through the wave path, and the distribution of the axial ellipsoidal drop symmetry orientation. A block diagram of the computer program for the determination of the joint probability density function of the attenuation and anisotropy is presented with numerical example. The effects of the parameters under discussion are discussed. Author (ESA)

N80-31723# Fondazione Ugo Bordoni, Rome (Italy).
INFLUENCE OF PROPAGATION CHARACTERISTICS AND REPEATERS ON THE PERFORMANCE OF A MULTIPLE LINK TELETEXT SYSTEM [INFLUENZA DELLE CARATTERISTICHE DI PROPAGAZIONE E DEI RIPETITORI SULLE PRESTAZIONI DI UN SISTEMA TELETEXT A PIU' RIMBALZI]
Paolo Mandarini (Rome Univ.) Dec. 1979 37 p refs In ITALIAN
(FUB-24-1979) Avail: NTIS HC A03/MF A01

A general method of system analysis is presented, and used for the determination of the error probability function for any given situation, including propagation or equipment anomalies. The method is also employed to determine the relationship between the mentioned anomalies and the variations in the signal to noise ratios. Two examples of teletext transmission simulation are given, one assuming ideal propagation conditions and the other assuming a 250 KHz detuning, in both from 14 dB down to an error probability of 10 to the minus 8th power. Author (ESA)

N80-31724# Fondazione Ugo Bordoni, Rome (Italy).
EVALUATION OF SERVICE AVAILABILITY IN A PACKET SWITCHING NETWORK [SULLA VALUTAZIONE DEL GRADO DI SERVIZIO DI UNA RETE A COMMUTAZIONE DI PACCHETTO]
Nicola Accarino, Giovanni Barbanera, and Claudio Rossi Sep. 1979 47 p refs In ITALIAN
(FUB-26-1979) Avail: NTIS HC A03/MF A01

After reviewing the problem parameters and defining the service availability as a function of the average delay time, the flow deviation method is used for optimizing the routing strategy of the network. The routing is of a proportional type based upon minimizing the average delay time. A computer program is presented and its applications are discussed. Author (ESA)

N80-31725# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
TRISTATIC SODAR [SODAR TRISTATICO]
A. Ricotta and M. Berico Mar. 1980 34 p refs In ITALIAN
(LPS-80-6) Avail: NTIS HC A03/MF A01

The operating principles of sodar (acoustic radar working at 1 to 3 kHz) are reviewed and a system using three modules placed at the vertices of a triangle is described. The tristatic system was developed to measure the wind total velocity vector and to explore boundary layer dynamics. Author (ESA)

N80-31726# Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.
A FEASIBILITY STUDY OF A SATELLITE FREQUENCY MODULATION BROADCASTING SYSTEM. VOLUME 3: COMPLEMENTARY STUDY ON THE ATTENUATION IN THE SHADOW ZONES, MULTIPLE PATHS, AND CIRCULAR POLARIZATION RECEPTION ANTENNAS Final Report [ETUDE DE FAISABILITE D'UN SYSTEME DE RADIODIFFUSION SONORE A MODULATION DE FREQUENCE PAR SATELLITE. VOLUME 3: COMPLEMENT D' ETUDE SUR ATTENUATION DANS LES ZONES D'OMBRE-TRAJETS MULTIPLES-ANTENNE DE RECEPTION EN POLARISATION CIRCULAIRE]
V. Biggi and F. Horgan (Telecommunications Ltd.) Dec. 1979 60 p Partly in ENGLISH and FRENCH
(Contract ESA-3208/77-F-HGE(SC))
(ESA-CR(P)-1313-Vol-3) Avail: NTIS HC A04/MF A01

The attenuation in shadow zones caused by several obstacles was measured. The statistical reception improvement obtained using space diversity by means of two antennas and two receptors on the same automobile was evaluated. It was found that in all cases a distinct improvement may be expected from a system of diversity reception. Measurements were made using a circularly polarized receiving antenna, resulting in a 3 dB improvement for the received signal. Author (ESA)

N80-31727# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE NOISE IN ELECTRIC NETWORKS [IL RUMORE NELLE RETI ELECTTRICHE]
G. V. Pallottino May 1980 52 p refs In ITALIAN
(LPS-80-10) Avail: NTIS HC A04/MF A01

Models representing noise in electrical networks with one or two ports are discussed. A general expression was derived for the noise factor and for noise temperature for the case of arbitrary correlation among equivalent noise generators. The problems related to networks implemented by several cascaded blocks are briefly discussed. Author (ESA)

N80-31728# National Technical Information Service, Springfield, Va.
TELECOMMUNICATION: ECONOMIC STUDIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1978
William E. Reed Jun. 1980 287 p
(PB80-811136) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Research on economic evaluations of the telecommunications industry is cited. Communication satellites, common carriers, cable television, telephones systems, and television systems are all covered in the bibliography. Economic studies of the foreign telecommunications industry are included. This updated bibliography contains 280 abstracts, none of which are new entries to the previous edition. GRA

N80-31729# National Technical Information Service, Springfield, Va.
TELECOMMUNICATION: ECONOMIC STUDIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - May 1980
William E. Reed Jun. 1980 67 p Supersedes NTIS/PS-79/0603; NTIS/PS-78/0581

(PB80-811144; NTIS/PS-79/0803; NTIS/PS-78/0581) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Research on economic evaluations of the telecommunications industry is cited. Communication satellites, common carriers, cable television, telephone systems, and television systems are all covered in the bibliography. Economic studies of the foreign telecommunications industry are included. This updated bibliography contains 60 abstracts, 36 of which are new entries to the previous edition. GRA

N80-31339# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
ELECTRO-MAGNETIC COMPATIBILITY
Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31340# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
CHECKING OF COMMUNICATIONS AND RADIO NAVIGATION SYSTEMS
Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 24 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-31730 Johns Hopkins Univ., Baltimore, Md.
HYBRID FAULT DIAGNOSIS IN DIGITAL SYSTEMS Ph.D. Thesis
Sivanaryana Mallela 1980 139 p
Avail: Univ. Microfilms Order No. 8020265

A systematic approach to fault diagnosis which considers the presence in a system of not only permanent faults, but also intermittent faults was developed. An analysis model of systems for relating tests and faults is presented which encompasses most of the existing models in the literature. To consider combinations of permanent and intermittent faults, the concept of a hybrid fault situation is introduced. A strategy is developed for the diagnosis of hybrid fault situations, and then, the resulting necessary and sufficient conditions on the test-fault interrelationships are derived. Lower bounds are determined on the hybrid fault diagnosability of a system in terms of its permanent fault diagnosability. These bounds establish that test sets with the same permanent fault diagnosing capability may have significantly different hybrid fault diagnosing capabilities. Hence, for efficient testing of a system, the choice of the tests to be applied to the system must, in general, be influenced by hybrid fault diagnosis considerations. Dissert. Abstr.

N80-31731*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIGITAL DEMODULATOR Patent Application
Thomas A. Shull, inventor (to NASA) Filed 18 Jul. 1980 9 p (NASA-Case-LAR-12659-1; US-Patent-Appl-SN-171928) Avail: NTIS HC A02/MF A01 CSCL 09C

A digital demodulator for converting pulse code modulated (PCM) data from phase-shift key (PSK) to non-return-to-zero (NRZ-L) and to bio phase (BiO-L) is described. The demodulator is composed of standard integrated logic circuits. The key to the demodulation function is a pair of cross coupled one shot multivibrators which, with a flip-flop produce the NRZ-L. In order to generate BiO-L, the PSK carrier is constrained to be 2 to the n times the data bit rate. If NRZ-L is all that is required, the circuitry is greatly simplified and the 2 to the n times bit rate constraint can be removed from the carrier. A flip-flop, an OR gate, an AND gate, and a binary counter generate the bit rate clock BTCK for the NRZ-L. The remainder of the circuitry is for converting the NRZ-L and BTCK into BiO-L. NASA

N80-31732*# RCA Labs., Princeton, N. J. Microwave Technology Center.
Ku-BAND FIELD-EFFECT POWER TRANSISTORS Final Report, 9 Nov. 1977 - 8 Aug. 1979
Gordon C. Taylor and Ho-Chung Huang Sep. 1979 152 p refs
(Contract NAS5-24355)
(NASA-CR-160010; PRRL-79-CR-39) Avail: NTIS HC A08/MF A01 CSCL 09C

A single stage amplifier was developed using an 8 gate, 1200 micrometer width device to give a gain of 3.3 + or - 0.1 dB over the 14.4 to 15.4 GHz band with an output power of 0.48 W and 15% minimum efficiency with 0.255 W of input power. With two 8 gate devices combined and matched on the device carrier, using a lumped element format, a gain of 3 dB was attained over the 14.5 to 15.5 GHz band with a maximum efficiency of 9.9% for an output power of 0.8 W. E.D.K.

N80-31733# Army Missile Command, Redstone Arsenal, Ala. Engineering Lab.
GOLD PLATED LEAD-CLINCHED LEAD SOLDER JOINT STUDY
Roger L. Yocom Sep. 1979 26 p refs
(AD-A087352; AD-E950003; DRSMI-E-79-29) Avail: NTIS HC A03/MF A01 CSCL 09/1

In this study the effects of soldering to gold-plated lead wires as opposed to soldering to pretinned or double-tin dipped lead wires are investigated. Also investigated were the differences between Types 1, 2, and 3 lead termination methods as described in MIL-P-46843, Paragraphs 3.6.4.3.7, 3.6.4.3.8, and 3.6.4.3.9 respectively. Data generated may be utilized in the design of printed circuit boards, the revision of soldering and component specifications, and for decision criteria upon which engineering changes may be evaluated. GRA

N80-31734# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
CAPACITORS FOR AIRCRAFT HIGH POWER Final Report, May 1975 - Oct. 1979
Robert D. Parker Apr. 1980 260 p
(Contract F33615-75-C-2021; AF Proj. 3145)
(AD-A087427; AFWAL-TR-80-2037) Avail: NTIS HC A12/MF A01 CSCL 09/1

This report describes an exploratory program conducted to develop reliable lightweight pulse discharge capacitors for airborne application. The specific duty was a 1 minute burst every 2 hours, and both low (50pps) and high (300pps) repetition rate service was to be considered. The energy density goals were 400 to 1100 J/kg with a 20 microsec capacitor current pulse width. A five layer polysulfone/kraft paper dielectric was selected for high rate service, while polyvinylidene fluoride/kraft paper was chosen for the low rate service. Both mineral oil and dioctylphthalate fluids were used. Tension controlled winding was used to eliminate failure producing folds. Reduced temperature drying further reduced wrinkles. Special filtration, purification, and cleaning produced very high resistivity fluids free from particles. A highly instrumented test bay accurately simulated a pulse forming network environment and allowed detailed and accurate testing. The best single section high rate results were 550 J/kg at 100,000 - 1,000,000 shot life at double the specified duty, while the best low rate results were slightly higher. Case weight minimization was studied, and three prototype lightweight cases were built. Several techniques for smoothing rough capacitor foils were examined, and a flame technique was selected as being most easily implemented. Problems of terminating extended foils were examined, and a flame-spray method selected as most practical. GRA

N80-31735# Litton Systems, Inc., San Carlos, Calif. Electron Tube Div.
NON-PERIODIC HELIX TWT STUDY Final Report
May 1980 53 p refs
(Contract N00173-76-C-0194)
(AD-A087413) Avail: NTIS HC A04/MF A01 CSCL 09/1

The purpose of this contract was to determine the feasibility of using various techniques to increase the operating voltages and peak power levels of helix type traveling-wave tubes. An oscillation suppression technique has been proposed which has application at high voltages and high frequencies. Based on a theoretical analysis of loading in transmission lines, calculations have been made which predict the presence of stopbands. Cold tests were performed which verified the accuracy of these calculations. A tube was built and tested. The test results indicate that the modes exist as predicted in cold test. Further testing is required to determine whether or not the stopband exists for hot test operation. GRA

N80-31736# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
POROUS ELECTRODE STUDIES Final Summary Report, 1973 - 1980
T. Katan Jul. 1980 27 p refs
(Contract N00014-73-C-0397)
(AD-A087528; LMSC-D766555) Avail: NTIS HC A03/MF A01 CSCL 07/4

Morphological and chemical changes are determined within the pores of analog porous electrodes to deduce the sequence of reactions and current distribution. The Silver/Silver Chloride System was shown to undergo a dissolution-diffusion-deposition during anodizing, and the applicability of the Newman-Bennion theory was demonstrated. GRA

N80-31737# New Mexico State Univ., Las Cruces.
THE USE OF MINIATURE ELECTRET MICROPHONES IN SMALL OPTOACOUSTIC CELLS Final Report
Stuart A. Schleusener 30 Jun. 1980 28 p refs
(Grant DAAG29-78-G-0080)
(AD-A087520; ARO-15969.1-GS) Avail: NTIS HC A03/MF A01 CSCL 09/5

Subminiature electret microphones were used in miniature spectrophone tests. Data has been obtained from gas mixtures with pressures as high as 660 Torr down as low as 2 Torr of CO2. Line broadening effects are very noticeable throughout the lower pressure region. Results show that subminiature electret microphones are competitive with other transducers in spectrophone work. GRA

N80-31738# Bendix Corp., Kansas City, Mo.
COST EFFECTIVE SYSTEM FOR CONNECTING MULTIWIRE CABLES TO PRINTED WIRING BOARDS Final Report
F. H. Lewis Mar. 1980 10 p
(Contract DE-AC04-76DP-00613)
(BDX-613-2302) Avail: NTIS HC A02/MF A01

A system flexible enough to meet present and future work requirements was developed. The Component Locator System usually is referred to as a Work Director. The Work Director shows the exact location for installing the wire on the pointed wiring board (PWB) and codes the Cable Scanner for the correct wire. The Cable Scanner then provides an audible signal when the operator touches the correct wire. This combination of Component Locator System and Cable Scanner eliminates the following operations: marking wires for identification; sorting marked wires when attaching to connectors; electrically checking wire number versus pin number; identifying wires by markings when installing them in the PWB; and determining the proper PWB hole location from a visual aid. DOE

N80-31739# Boston Univ., Mass.
INFRARED ABSORPTION SPECTRUM OF FREE CARRIER IN POLAR SEMICONDUCTORS Progress Report, 1 Jul. 1979 -30 Jun. 1980
B. Jensen Feb. 1980 11 p refs
(Contract DE-AC02-79ER-10444)
(DOE/ER-10444/1) Avail: NTIS HC A02/MF A01

The Drude Zener Theory of the absorption of high frequency radiation by free carriers was extended into the quantum region in terms of a frequency dependent relaxation time which predicts the dc mobility in the quasiclassical limit. Numerical calculations of the frequency and concentration dependent electron scattering rate were completed for InP, InAs, Ga(0.47)In(0.53)As, and previous results for GaAs extended to high carrier concentrations. Calculated results for GaAs are in good agreement with experimental measurements of the mobility which are found to be independent of a wide variety of conditions of material preparation. This indicates that disagreement with previous theoretical calculations was not due to compensation. Calculations for ZnSe and further investigation of the modification of the optical constants by the presence of an intense laser field and by a static magnetic field are currently planned. DOE

N80-31740# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France). Dept. ETE.
VOLTAGE CONVERTER (DC/DC) USED ON A SATELLITE. APPLICATIONS TO THE ARCAD 3 AND PICPAB PROJECTS [CONVERTISSEUR D'ALIMENTATION DC/DC EMBARQUE SUR SATELLITE. APPLICATIONS AUX PROJETS ARCAD 3 ET PICPAB]
M. Auger 2 Nov. 1979 54 p refs In FRENCH
(CRPE-NT-77) Avail: NTIS HC A04/MF A01

The specifications of a converter of the type used for the ISOPROBE experiment are given. A model was built and tested, the ARCAD3. The circuit diagrams are presented and problems discussed in terms of off-the-shelf components presently available. Author (ESA)

N80-31741# Royal Signals and Radar Establishment, Malvern (England).
MICROWAVE FREQUENCY MEMORY
C. M. Boyne London HMSO Mar. 1980 16 p refs
(RSRE-Memo-3257; BR74217) Avail: NTIS HC A02/MF A01

A circuit is described which is capable of remembering the frequency of a single pulse of RF in the band 9.2 - 9.8 GHz. The minimum pulse duration is 100 nsec and the set on accuracy is to within + or - 5 MHz. The memory is an oscillator which is set to one of a number of discrete frequencies by the injection of an RF pulse. It is shown that the oscillator can be switched to a new frequency at any time by injecting a new signal. Author (ESA)

N80-31742# Defence Research Information Centre, Orpington (England).
INTEGRATION OF FILTERS BY MEANS OF LINEAR MOS CIRCUITS
P. Christiansen, P. J. Gebhardt, and G. Kohlbacher London May 1980 37 p refs Transl. into ENGLISH from Wiss. Ber. AEG-Telefunken, v. 52, no. 1/2, 1979 p 131-138 Sponsored by Bundesministerium fuer Forschung und Technologie
(DRIC-T-6106; BR74161) Avail: NTIS HC A03/MF A01

The implementation and characteristics of charge coupled device filters and switched capacitor filters produced using linear MOS technology are described. The analysis includes a discussion of circuit sections such as input stages, differential current integrator, clock pulse generator, inverters, source followers, differential amplifiers, and operational amplifiers, all using linear MOS circuit techniques. Author (ESA)

N80-31743# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ATMOSPHERIC ELECTRICITY-AIRCRAFT INTERACTION
May 1980 227 p refs Lectures held in London, 9-10 Jun. 1980, in Munich, 12-13 Jun. 1980, and in Menlo Park, Calif., 24-25 Jun. 1980
(AGARD-LS-110; ISBN-92-835-1361-4) Avail: NTIS HC A11/MF A01

The fundamentals of atmospheric electricity phenomena are reviewed with emphasis on the hazards, criteria, testing, and protection of aircraft. Insights are provided from both pilot and design perspectives. For individual titles, see N80-31744 through N80-31757.

N80-31744# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
ATMOSPHERIC ELECTRICITY INTERACTIONS WITH AIRCRAFT: AN OVERVIEW
Gary A. DuBro *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 11p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Concern for the vulnerability of aircraft flight-critical and

mission-critical avionics to atmospheric electricity hazards has increased over the last fifteen years. The major hazards of concern are lightning and static electrification. Two primary factors have contributed to a potentially increased threat to new generation aircraft: (1) increasingly widespread use of sensitive microelectronics in flight-critical and mission-critical electronic and electrical systems; and (2) the reduced electromagnetic shielding afforded by many advanced structural materials. A description of the atmospheric electricity interaction with aircraft and the manner in which it impacts the aircraft avionics is summarized. Key areas of pertinent research and development are identified and the present state of the art in each of these key areas is presented. E.D.K.

N80-31745# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT MISHAP EXPERIENCE FROM ATMOSPHERIC ELECTRICITY HAZARDS
Don W. Clifford *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 17 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Aircraft mishaps resulting from inflight lightning strikes can range from inconsequential to catastrophic. A basic understanding of how lightning affects aircraft, based upon both military and commercial experience is established. Pilot reports of some representative incidents are described in detail, illustrating how the various atmospheric conditions and interaction mechanisms have affected aircraft operations. A summary of inflight mishap conditions is presented describing the range of flight circumstances under which aircraft are usually struck. The interaction of high current arcs with structural and external electrical hardware, the effects of electromagnetic coupling to interior avionics, and the effects of corona and high voltage sparking are also discussed. E.D.K.

N80-31748# Tuebingen Univ. (West Germany).
PHENOMENOLOGY OF LIGHTNING/AIRCRAFT INTERACTION
R. P. Muehleisen *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 6 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Two types of lightning discharges having different characteristics are intracloud and cloud to cloud discharges and cloud to ground discharges. The many hypotheses of thundercloud electrification are introduced. Calculation results and graphs are given due to the electric field strength around thunderclouds. The distortion of these fields by aircraft bodies and the initiation of triggered lightnings are described. E.D.K.

N80-31747# Lightning Technologies, Inc., Pittsfield, Mass.
SUSCEPTIBILITY OF AVIONICS TO LIGHTNING INDIRECT EFFECTS
J. Anderson Plumer *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 27 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The ways that lightning currents may flow in an airframe and basic mechanisms whereby these currents may induce transient voltages and currents in typical aircraft electrical circuits are described. Examples of induced voltages and currents measured during simulated lightning tests are presented and significant aspects are discussed, together with estimates of the ranges of induced voltages to be expected in typical circuits. Examples of the magnetic fields that are responsible for some of these induced effects are also presented. A discussion of the basic damage effects that lightning induced voltages may have on typical solid state electronic components is included. E.D.K.

N80-31748# United Kingdom Atomic Energy Authority, Abingdon (England).
MODELS FOR ASSESSING HAZARDS DUE TO LIGHTNING
P. F. Little *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 14 p refs Sponsored by the UK Ministry of Defence (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The characteristics of lightning current pulses and the radiated fields produced by lightning are summarized. The transmission line model of the ground flash is considered and the derivation of the parameters of the line from the physical processes taking place is treated in various degrees of approximation. Changes in the shape of the current pulse occur as the return stroke is propagating and the implications of these changes in waveform are discussed. The transition from leader channel to return stroke channel may be regarded as a shock front and this aspect is explored also in respect of the leader advance. The coupling of fields and currents due to lightning into the aircraft when it forms part of the return stroke channel and when it is close to an independent stroke is considered in the light of these physical models. Author

N80-31749# McDonnell Aircraft Co., St. Louis, Mo.
LIGHTNING TEST CRITERIA FOR AIRCRAFT AVIONICS SYSTEMS
Don W. Clifford *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 12 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The evolutionary history of the test criteria for lightning testing of aerospace systems and avionics equipment is presented along with a summary of the salient features and the rationale for selection of the parameters specified in the documents. Test criteria are set forth in terms of the various current and voltage waveforms to be used in lightning tests. The simulation waveforms are based upon statistical summaries of the natural lightning environment. Modern tests criteria documents account for the dynamic nature of the lightning interaction with aircraft by using the zonal concept to more accurately identify the threat to specific systems and equipment. Test techniques can affect simulated lightning test results and the modern criteria documents include recommended practices for achieving accurate and consistent results. Some predictions of future changes in the criteria documents are made on the basis of information about the lightning threat based upon recent measurements of natural lightning. E.D.K.

N80-31750# McDonnell Aircraft Co., St. Louis, Mo.
LIGHTNING TESTING FOR AIRCRAFT AVIONICS SYSTEMS
Don W. Clifford *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 23 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The test techniques used to evaluate lightning effects on avionics equipment are discussed. The facilities necessary to produce the current and voltage waveforms specified in the criteria documents are briefly described as are the sensors and instrumentation used to measure and record the test data. Where test setup details can affect test results, the preferred techniques are described. Techniques for full vehicle tests are discussed briefly as they may impact the next generation of criteria documents. E.D.K.

N80-31751# United Kingdom Atomic Energy Authority, Abingdon (England).
THE COUPLING OF LIGHTNING FIELDS INTO AIRCRAFT AND CABLES
P. F. Little *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 14 p refs Sponsored by the UK Ministry of Defence (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The current distribution in the skin of an aircraft struck by lightning is described and the effects of airframe resonance are noted. Nearby strikes produce initially an electromagnetic pulse which is scattered by the aircraft, creating circulating currents in the skin: this process is considered. The magnetic fields at the surface diffuse into the skin, and significant currents flow on the interior after a time lag dependent on the skin resistivity. In addition, the surface fields couple directly into the interior through breaks in the conducting skin or through insulating panels. Methods of calculating the magnetic and electric fields in the interior of the aircraft are discussed, and the effects on electrical and electronic systems described. The screening of internal cabling is reviewed. Author

N80-31752# Lightning Technologies, Inc., Pittsfield, Mass.
PROTECTION OF AIRCRAFT AVIONICS FROM LIGHTNING INDIRECT EFFECTS
J. Anderson Plumer *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 26 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The estimation of magnitudes of voltages and currents induced on shielded and unshielded wiring, and the utilization of shields to reduce the level of these effects in sensitive circuits is discussed. Circuit design practices that also can be utilized to minimize induced effects are reviewed along with the various types of surge suppression devices that are available and the advantages and disadvantages of each. Transient coordination and methods of verification are discussed. M.G.

N80-31753# Lightning Technologies, Inc., Pittsfield, Mass.
LIGHTNING EFFECTS ON AIRCRAFT: A COCKPIT PERSPECTIVE
J. Anderson Plumer *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 12 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Typical conditions in which strikes have been experienced by large and small aircraft are described, together with effects as experienced by flight crews. Most strikes have occurred when the aircraft is flying at between 3000 and 5000 meters altitude, where the outside air temperature is within 5 deg of 0 C and there exists a light to moderate amount of precipitation. Strikes to aircraft have, however, occurred at altitudes as high as 12,000 m and also when the aircraft are parked on the ground. If an aircraft approaches a highly electrified region it may actually trigger a strike, especially if the aircraft is large and causes a significant perturbation in the nearby electric field. Aircraft lightning strike mechanisms, effects to avionics and electric power systems, engine effects, and effects to personnel are addressed. M.G.

N80-31754# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
BASIC PHENOMENOLOGY OF ELECTRICAL DISCHARGES AT ATMOSPHERIC PRESSURE
Joseph Taillet *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 19 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The mechanism of three types of discharge induced by static charging (spark, corona, and surface streamers) is described in detail. From this mechanism, the radioelectric noise emitted by these discharges is predicted. It is concluded that sparks and surface streamers are generators of powerful radioelectric disturbances. Proper bonding eliminates sparks and specific treatments suppress surface discharges. Coronas are necessary for getting rid of the accumulated static charge. On the one hand, attention should be given to reducing as much as possible the coupling between coronas discharges and antennas of the avionic system. On the other hand, use of corona microdischarges can bring a further improvement in static noise reduction. M.G.

N80-31755# SRI International Corp., Menlo Park, Calif. Electromagnetic Sciences Lab.
STATIC CHARGING EFFECTS ON AVIONIC SYSTEMS
J. E. Nanevicz *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 15 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The electromagnetic character of various noise sources--corona discharge, surface streamers, and spark discharges are discussed. The results of flight tests and laboratory discharge simulations are given. In general, the source data exist both as time domain waveforms and as frequency domain spectra. The differences between the noise signals generated by the different sources are discussed, and the dependence of noise levels on aircraft charging current are indicated. Results of laboratory determinations of coupling between source locations and antennas are also presented together with the results of flight test experiments conducted to verify the coupling information. Finally, the source data is combined with the coupling information to predict the equivalent noise fields to be expected at typical antenna locations on aircraft. These noise fields are compared to atmospheric noise levels to determine the degree of system performance degradation that can result from precipitation static noise. M.G.

N80-31756# SRI International Corp., Menlo Park, Calif. Electromagnetic Sciences Lab.
ALLEVIATION TECHNIQUES FOR EFFECTS OF STATIC CHARGING ON AVIONICS
J. E. Nanevicz *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 14 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The various mechanisms by which static charging of aircraft affects avionic systems are identified, and techniques to mitigate the effects are described. Noise reduction schemes intended to eliminate aircraft charging itself are confined to the elimination of surface streamer discharges on electrically insulating frontal surfaces by coating the surface with electrically conductive material. This procedure allows the charging current to flow off the surface as rapidly as it arrives without generating noise. Another technique for eliminating surface streamer noise at the source is simply to relocate insulating materials (i.e., antenna insulating materials) to regions at the aft of the aircraft where they will not be charged by impinging precipitation particles or to install particle deflectors upstream of the dielectric surface. Successful techniques for the control of corona discharge noise involve forcing the discharge to occur from special discharging devices installed at high field regions on the aircraft where corona discharges are likely to occur naturally. The dischargers are designed to reduce the corona source intensity and to decouple the discharge source from the airframe. Practical dischargers are capable of reducing corona discharge noise by as much as 60 dB. Noise generated by sparking between sections of the metal structure can be eliminated by electrical bonding of all portions of the structure. Descriptions of techniques demonstrated by laboratory and flight tests to be successful in controlling precipitation charging interference are given. M.G.

N80-31757# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
AIRCRAFT STATIC CHARGING TESTING
Joseph Taillet *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 7 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

A procedure is proposed for: (1) characterizing in the laboratory the effects of aircraft charging on the operation of unprotected navigation and communication systems; (2) assessing in the laboratory the validity of the protective methods; (3) checking in the factory the correct application of these methods; (4) routine testing between flights, in the field, of the good condition of the protecting devices and treated surfaces. A test method is developed which would include checking the bonding between metallic surfaces, measuring the value of surface resistance of semi-conductive coatings or resistive paints deposited over insulating substrate, simulating tribo-electric charging or charge collection separately on any surface element of the aircraft, and verifying that the coupling between dischargers and antennas is minimal. M.G.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-31758 Lehigh Univ., Bethlehem, Pa.
MULTISYSTEM MODELING OF UNSTEADY LIQUID FLOW Ph.D. Thesis
Joel Leonard Caves 1980 230 p
Avail: Univ. Microfilms Order No. 8019708

A single set of governing equations called system-independent

equations, is derived describing the conservation of mass and momentum for flow through a generalized porous conduit. Generic coefficients in the system-independent equations relate the changes in liquid and conduit properties to the variations in pressure and velocity. Supplemental system-dependent equations or laboratory experimentation can be used to quantify the coefficients for each particular flow system. The validity of the system-independent equations is shown by comparison with traditional solutions to single-system problems of transient flow in a closed conduit, an open channel, an unconfined aquifer, and a confined aquifer. Computer simulations of the classical problem involving free surface and pressurized flow in the Wettingen Tunnel and of a stream-aquifer interaction problem demonstrate the value of the system-independent equations for transient analysis of multisystem problems where the completeness, practicality, and versatility of the equations can be exploited. Dissert. Abstr.

N80-31759*# Sheffield Univ. (England). Dept. of Chemical Engineering.

INVESTIGATIONS OF EDDY COHERENCE IN JET FLOWS

A. J. Yule 1980 27 p refs Presented at Intern. Conf. on the Role of Coherent Structures in Modelling Turbulence and Mixing, Madrid, 25-27 Jun. 1980

(Grant NSG-7517)

(NASA-CR-163525) Avail: NTIS HC A03/MF A01 CSCL 20D

In turbulent shear flow the term coherent structures refers to eddies which are both spatially coherent, i.e., large eddies, aand also temporally coherent, i.e., they retain their identities for times which are long compared with their time scales in fixed point measurements. In transitional flows, the existence of such structures is evident from flow visualizations. In many other flows, such structures are not so evident. The reasons for the existence of these two classes of flows are discussed and attension is focused upon the more difficult flows, where coherent structures are not so evident. Techniques by which the existence (or nonexistence) of such structures in these flows can be established from point measurements, are also discussed. A major problem is shown to be the need to discriminate between real losses in eddy coherence and apparent losses in coherence introduced by phase scrambling effects which 'smear' multipoint correlations. The analysis of multiprobe time dependent data in cold and reacting round turbulent jets is described and it is shown how evidence of strong eddy coherence can be extracted from data. R.K.G.

N80-31760*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.

AN EXPERIMENTAL STUDY OF MULTIPLE JET MIXING

D. Krothapalli, D. Baganoff, and K. Karamcheti Jun. 1979 162 p refs

(Grants NsG-2007; NsG-2233)

(NASA-CR-163537; SU-JIAA-TR-23) Avail: NTIS HC A08/MF A01 CSCL 20D

Measurements of an incompressible jet issuing from an array of rectangular lobes, equally spaced with their small dimensions in a line, both as a free jet, and as a confined jet, are carried out in three parts: (1) on a single rectangular free jet, (2) on the same jet in a multiple free jet configuration, and (3) on the same jet in a multiple jet configuration with confining surfaces (two parallel plates are symmetrically placed perpendicular to the long dimension of each lobe covering the entire flow field under consideration). In the case of a single rectangular free jet, the flow field of the jet is characterized by the presence of three distinct regions in the axial mean velocity decay and are referred to as: potential core region, two dimensional type region, and axisymmetric type region. In the case of a multiple free jet, the flow field for downstream distance X greater than 60D (D = width of a lobe) resembles that of a jet exiting from a two dimensional nozzle with its short dimension being the long dimension of the lobe. S.F.

N80-31761# Applied Research Lab., State College, Pa.

WATER TUNNEL SIMULATION STUDY OF THE LATER STAGES OF WATER ENTRY OF CONICAL HEAD BODIES. PHASE 2: EFFECT OF THE AFTERBODY ON STEADY STATE VENTILATED CAVITIES

D. R. Stinebring and J. W. Hall 3 Dec. 1979 74 p refs

(Contract N00024-79-C-6043)

(AD-A086980; ARL/PSU-TM-79-206) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report documents the second phase of the water tunnel studies that are intended to simulate the cavity running phase of water entry. The primary purpose of the investigation was to study the effect of afterbody arrangement on steady state ventilated cavities. The models utilized were 1.0 inch diameter conical nosed bodies with a 45 deg. apex angle. Three models were tested: one having a 1.0 inch diameter afterbody, one having a 0.5 inch diameter afterbody and the third having no afterbody. The cavitation number as a function of cavity length and ventilation air flow coefficient as a function of cavitation number were measured for all models. The pressure distribution was found for a wide range of cavity lengths for the model with the 1.0 inch diameter afterbody. Data for the ventilation air flow coefficient and pressure distribution are in good agreement with previous studies of similar models. An interesting result is that the model requiring the lowest ventilation air flowrate for a given cavitation number was the model with no afterbody. For most of the flow states investigated, the model with the 0.5 inch diameter afterbody required the highest flowrate. The transition between the reentrant jet and twin vortex regimes was studied briefly. At transition, the cavity would grow four or five times its original length for a slight increase in ventilation air flowrate. A cavity attrition test was conducted to simulate the decay of a cavity behind a missile. GRA

N80-31762# Applied Research Lab., State College, Pa.

A SPLINE RELAXATION PROCEDURE FOR CALCULATING AXISYMMETRIC FLOW FIELDS ABOUT BODY/PROPELLER COMBINATIONS. 1: FROZEN VORTICITY AND POTENTIAL FLOWS

G. H. Hoffman 14 May 1980 49 p refs

(Contract N00024-79-C-6043)

(AD-A087027; ARL/PSU-TM-80-108) Avail: NTIS HC A03/MF A01 CSCL 20/4

A general numerical solution method is presented for calculating incompressible axisymmetric viscous/turbulent flow in the tail-near wake region of a body-propeller combination. The method makes use of the parabolic vorticity transport approximation in conjunction with polynomial splines to achieve sufficient accuracy in high flow gradient regions with as few grid points as possible. A sheared body fitted coordinate system is used and the numerical solution of the finite difference equations is obtained by standard line overrelaxation. This report presents the details of the method for the first phase of the work where the vorticity transport equation is omitted (frozen vorticity flow). Sample potential flow and frozen vorticity solutions are presented with no propeller present. GRA

N80-31763# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.

HYDRODYNAMIC COEFFICIENTS FOR VERTICAL CIRCULAR CYLINDERS AT FINITE DEPTH

Tanik Saburncy (Teknik Univ., Istanbul) and Sander Calisal 1980 74 p refs

(AD-A087334; USNA-EW-11-80) Avail: NTIS HC A04/MF A01 CSCL 20/4

Hydrodynamic coefficients for vertical circular cylinders at finite water depth are obtained and presented for different depth to radius and draft to radius ratios. A summary of equations for computer application is also presented. Limiting values for heave added mass for zero frequency is also discussed. GRA

N80-31764# Lumley (John L.), Ithaca, N.Y.

***THE PRESSURE FOOTPRINT OF A TURBULENT LAYER ON A COMPLIANT BOUNDARY* Technical Report, 1 Aug. 1979 - 31 Jul. 1980**

John L. Lumley 31 Jul. 1980 53 p refs

(Contract N00014-79-C-0727)

(AD-A087296) Avail: NTIS HC A04/MF A01 CSCL 20/4

An examination was made of one way in which a compliant boundary may affect the low wavenumber pressure field measured at the surface under a turbulent boundary layer. Specifically, we assume that the low wavenumber pressure field measured at the wall results from the large scale motions in the outer part of the flow, and that these are triggered by the bursting in the

buffer layer, which is caused in its turn by secondary instabilities growing on inflectionary profiles caused by longitudinal vortices in the sub and buffer layers. The direct effect of the compliant boundary on the growth of these longitudinal vortices, using the energy method, was examined. We represent the compliant boundary by a half space filled with a linear visco-elastic medium with a single time constant. We find that the effect of the boundary is to introduce an effective slip in the boundary condition on the disturbance (the longitudinal vortices), producing a boundary condition intermediate between the inviscid boundary condition and the no-slip boundary condition. Since this boundary condition is less dissipative, the vortices are less stable, and have a higher growth rate. They might consequently be expected to grow faster and occur more frequently, if this were the only mechanism involved, resulting in a shift of the low wavenumber pressure spectrum to higher frequencies. This appears to be the opposite of observations, suggesting that other mechanisms are involved. GRA

N80-31765# Rockwell International Corp., Columbus, Ohio. North American Aircraft Div.

DEVELOPMENT OF A NOZZLE TO IMPROVE THE TURNING OF SUPERSONIC COANDA JETS Final Report, 15 Jun. 1979 - 15 Mar. 1980

Paul M. Bevilaqua and John D. Lee Apr. 1980 58 p refs

Prepared in cooperation with Ohio State Univ., Columbus

(Contract F33615-79-C-3026; AF Proj. 2404)

(AD-A087709; NR80H-18; AFWAL-TR-80-3027) Avail: NTIS HC A04/MF A01 CSCL 20/4

The hypothesis that shaping the jet velocity profile improved the thrust vectoring of supersonic Coanda jets was experimentally tested. A new nozzle design procedure, based on the method of characteristics, was developed to design a nozzle which delivers an arbitrary exit velocity profile. Such a nozzle was designed for a pressure ratio of 2.5, to provide a jet matched to a circular Coanda surface with radius equal to five jet thicknesses. The thrust vectoring of this nozzle was then compared to that of a convergent divergent nozzle over a range of pressure ratios from 1.5 to 3.5. It is concluded that supersonic nozzles provide greatly improved turning of Coanda jets, and that shaping the velocity profile further improves the thrust vectoring. GRA

N80-31766# AeroChem Research Labs., Inc., Princeton, N. J.

EXPERIMENTAL STUDY OF CHEMICALLY REACTING TURBULENT FREE SHEAR LAYERS Final Report, 23 Sep. 1976 - 30 Nov. 1978

Robert K. Gould Feb. 1980 55 p refs

(Contracts EX-76-C-01-2446; E(49-18)-2446)

(FE-2446-8) Avail: NTIS HC A04/MF A01

The model chemical reaction used to study turbulent mixing/reacting flows was the NO/O3 reaction. A novel photolysis/chemiluminescence technique was employed to measure reactant concentrations, c/sub NO/ and c/sub O3/, and a product concentration, c/sub NO2/, simultaneously at points in the flow field. From such measurements, the required statistical quantities, i.e., probability density functions and correlations of reactants and product concentrations, are obtained. These data were supplemented by measurements of the turbulence power spectra and intensity throughout the flow. The flow studied was an axisymmetric turbulent jet exhausting into a nearly stationary, uniform channel flow. Cases examined were a reacting case in which the jet contains dilute O2 in N2 and the channel flow is dilute NO in N2; and a nonreacting (but otherwise identical flow) in which a jet of N2 containing small quantities of NO and NO2 exhausts into pure N2. DOE

N80-31767# Sandia Labs., Albuquerque, N. Mex. Fluid and Thermal Sciences Dept.

EXPERIMENTAL STUDY OF THE STEADY NATURAL CONVECTION IN A HORIZONTAL ANNULUS WITH IRREGULAR BOUNDARIES

R. D. Boyd 1980 66 p refs Presented at the 19th Natl. Heat Transfer Conf., Orlando, Fla., 27 Jul. 1980

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-2354C; CONF-800723-1) Avail: NTIS HC A04/MF A01

The natural convective heat transfer across an annulus with irregular boundaries was studied using a Mach-Zehnder interferometer. The annulus was formed by an inner hexagonal cylinder and an outer concentric circular cylinder. This configuration models, in two dimensions, a liquid metal fast breeder reactor spent fuel subassembly inside a shipping container. During the test, the annulus was filled with a single gas, either neon, air, argon, krypton, or xenon, at a pressure of about 0.5 MPa. From temperature measurements, both local and mean Nusselt numbers (Nu/sub delta/) at the surface of the inner cylinder were evaluated, with mean Rayleigh number (anti Ra/sub delta/) varying from 4.54 X 10 to the 4th power to 0.915 x 10 to the 6th power (delta is the local gas width). DOE

N80-31768# E-Systems, Inc., Greenville, Tex.

DEMONSTRATION OF FIBER OPTIC LINK APPLICATIONS IN UTILITY PLANT MULTIPLEXED INSTRUMENT AND CONTROL SYSTEMS Final Report

W. D. Redus, G. R. Craig, and W. J. B. Oldham Jan. 1980 111 p Sponsored by EPRI

(EPRI Proj. 1173-1)

(EPRI-NP-1322) Avail: NTIS HC A06/MF A01

The application of data transmission via fiber optic cables was demonstrated for a utility plant instrumentation system. The project demonstrated that fiber optics is a viable method of transmitting I&C instrumentation. There is a cost penalty for light transmitters, receivers, and higher cable cost, which must be weighed against the advantages. The light beam and cable are essentially immune to crosstalk, electromagnetic interference, switching and transient interference, humidity, pressure, and reasonable temperature environments. There are potential handling difficulties with glass cable since a crimp or sharp bend radius will break the cable. A reasonable field-installable connector is essential. Plastic cable is very readily installed, spliced, and handled. Its major limitation is the higher transmission loss that restricts plastic cable to shorter runs of a few hundred feet. A time domain reflectometer (light beam radar) can locate cable breaks and is necessary for plant installations. Cables must be marked for distance locations. DOE

N80-31769# California Univ., Livermore. Lawrence Livermore Lab.

NUMERICAL CALCULATION OF THERMAL CONVECTION IN POROUS MEDIA IN TWO DIMENSIONS WITH APPLICATIONS TO NUCLEAR REPOSITORY DESIGN

D. E. Maiden May 1980 15 p refs

(Contract W-7405-eng-48)

(UCID-18700) Avail: NTIS HC A02/MF A01

A computer code HP2D was developed to calculate the effect. Transient and steady state heat and fluid flow in porous media are calculated. The code allows for anisotropy of hydraulic conductivities, temperature dependent fluid density and viscosity. A heat source and a variety of temperature and flow boundary conditions can be easily employed. The code solves two coupled governing equations. The time dependent heat transport is solved by an alternating direction implicit technique; and the steady state flow of water is solved by a Gauss-Seidel Poisson solver. A sample calculation of thermal convection about a repository is given. DOE

N80-31770# General Electric Co., Schenectady, N. Y. Mechanical Systems and Technology Lab.

LAMINAR FLOW CYCLONE DEVELOPMENT PROGRAM Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980

W. B. Giles and K. L. Bekofske Apr. 1980 22 p

(Contracts DE-AC21-78ET-11031; ET-78-C-01-3242)

(FE-3242-40) Avail: NTIS HC A02/MF A01

A modified water flow model to study the influence of inlet wall heating is discussed. This wall heated model of the radial inflow region has been adapted with additional thermocouples, plus insulation of the rim. The data continue to indicate highly stable flow conditions up to the maximum test Reynolds numbers. DOE

N80-31771# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A STUDY INTO THE USE OF A PHOTON CORRELATION TECHNIQUE IN BOTH LOW AND HIGH SPEED FLOWS

R. S. Figliola and G. Vorropoulus Feb. 1980 34 p refs

(VKI-TM-27) Avail: NTIS HC A03/MF A01

A laser anemometer system using a photon correlation technique in conjunction with a dual beam-Doppler difference optical system was tested. An introduction to the technique is presented. Correlograms were obtained in both low and high speed flows having various degrees of turbulence. Comparisons are made with measurements from a pilot-static tube, a hot-wire anemometer, and a period counter processor. The technique obtained good results even at extremely low light levels with signals of poor signal to noise ratio at velocities up to M = 1.2. Author (ESA)

N80-31772# Maryland Univ., College Park. Dept. of Mechanical Engineering.
TWO-PHASE FLOW MODEL TEST FACILITY Interim Report, 15 Aug. 1975 - 31 Jan. 1977
Dirse W. Sallet, Manfred Guehler, and Chung Y. Tsui Apr. 1980 26 p
(Contract DOT-FR-64181)
(PB80-181647; FRA/ORD-76/298) Avail: NTIS HC A03/MF A01 CSCL 20D

Test facilities for the investigation of two phase flows are described. The test facility completed to this date consists of the blow down test apparatus and the bubble and slug flow tunnel. It is the purpose of the test facilities to support, test and aid in the development of safety valve sizing equations when different two phase regimes occur. GRA

N80-31773# National Bureau of Standards, Washington, D.C. Building Thermal and Service Systems Div.
METHOD OF TESTING, RATING AND ESTIMATING THE HEATING SEASONAL PERFORMANCE OF HEAT PUMPS
Walter H. Parken, Jr., George E. Kelly, and David A. Didion Apr. 1980 66 p Sponsored in part by DOE
(PB80-185622; NBSIR-80-2002) Avail: NTIS HC A04/MF A01 CSCL 13A

Test and rating procedures are presented for electrically driven residential air to air heat pumps operating in the heating mode. The procedures are designed to include the effects of part load (cyclic) operation, variations in outdoor temperature, and frost formation on the heating performance. Using the test procedure results, a calculation procedure is presented for estimating the heating seasonal performance and cost of operation of residential heat pump units. GRA

N80-31664 Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
MODELING OF FLUID TRANSIENTS IN MACHINES. PART 2: ADVANCED CONSIDERATIONS
R. Singh *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 11-17 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-31774*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FILM ADVANCE INDICATOR Patent Application
E. Thomas Freeman, Charles W. Stump, and Francis R. Dreisbach, inventors (to NASA) Filed 18 Jul. 1980 9 p
(NASA-Case-LAR-12474-1; US-Patent-Appl-SN-171934) Avail: NTIS HC A02/MF A01 CSCL 14E

A film advancement indicator which includes an optical sensor that detects the rotational movement of a disc that rotates only when the film advances is described. When the film does not advance an indicator light is activated. A counter is included in the electronic circuit to determine the number of film frames advanced. NASA

N80-31775*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DATA ACQUISITION TECHNIQUES FOR EXPLOITING THE UNIQUENESS OF THE TIME-OF-FLIGHT MASS SPECTROMETER: APPLICATION TO SAMPLING PULSED GAS SYSTEMS
Kenneth A. Lincoln Aug. 1980 15 p refs Presented at the Dyn. Mass Spectrometry Symp., Canterbury, England, 7-10 July 1980
(NASA-TM-81224; A-8308) Avail: NTIS HC A02/MF A01 CSCL 14B

Mass spectra are produced in most mass spectrometers by sweeping some parameter within the instrument as the sampled gases flow into the ion source. It is evident that any fluctuation in the gas during the sweep (mass scan) of the instrument causes the output spectrum to be skewed in its mass peak intensities. The time of flight mass spectrometer (TOFMS) with its fast, repetitive mode of operation produces spectra without skewing or varying instrument parameters and because all ion species are ejected from the ion source simultaneously, the spectra are inherently not skewed despite rapidly changing gas pressure or composition in the source. Methods of exploiting this feature by utilizing fast digital data acquisition systems, such as transient recorders and signal averagers which are commercially available are described. Applications of this technique are presented including TOFMS sampling of vapors produced by both pulsed and continuous laser heating of materials. E.D.K.

N80-31776*# Barnes Engineering Co., Stamford, Conn.
SELENIUM IMMERSED THERMISTOR BOLOMETER STUDY Final Technical Report, Sep. 1978 - Mar. 1979
W. H. Rolls Jun. 1979 42 p
(Contract NAS5-25319)
(NASA-CR-160013; BEC-2774) HC A03/MF A01 CSCL 14B

The noise characteristics of thermistor bolometers immersed in layers of arsenic/selenium glass uniform in composition were examined. Using a controlled deposition technique, layers of glass were deposited, thermistor bolometers immersed, and their electrical characteristics measured after various thermal treatments. Markedly improved stability of the detector noise was observed using this new technique. L.F.M.

N80-31777*# United Technologies Research Center, East Hartford, Conn.
DESIGN, FABRICATION AND TESTING OF AN OPTICAL TEMPERATURE SENSOR
W. W. Morey, W. H. Glenn, R. O. Decker, and W. C. McClurg Jul. 1980 54 p refs
(Contract NAS3-21841)
(NASA-CR-165125; R80-924624-11) Avail: NTIS HC A04/MF A01 CSCL 14B

The laboratory breadboard optical temperature sensor based on the temperature dependent absorptive characteristics of a rare earth (europium) doped optical fiber. The principles of operation, materials characterization, fiber and optical component design, design and fabrication of an electrooptic interface unit, signal processing, and initial test results are discussed. Initial tests indicated that, after a brief warmup period, the output of the sensor was stable to approximately 1 C at room temperature or approximately + or - 0.3 percent of point (K). This exceeds the goal of 1 percent of point. Recommendations are presented for further performance improvement. L.F.M.

N80-31778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF ELECTRICAL NOISE IN SELENIUM-IMMERSED THERMISTOR BOLOMETERS
John L. Tarpley and Pedro D. Sarmiento Aug. 1980 30 p refs
(NASA-TM-82001) Avail: NTIS HC A03/MF A01 CSCL 14B

The selenium immersed, thermistor bolometer, IR detector failed due to spurious and escalating electrical noise outburst as a function of time at elevated temperatures during routine ground

based testing in a space simulated environment. Spectrographic analysis of failed bolometers revealed selenium pure zones in the insulating selenium arsenic (Se-As) glass film which surrounds the active sintered Mn, Ni, Co oxide flake. The selenium pure film was identified as a potentially serious failure mechanism. Significant changes were instituted in the manufacturing techniques along with more stringent process controls which eliminated the selenium pure film and successfully produced 22 study bolometers. S.F.

N80-31779# Texas Technological Univ., Lubbock. Optical Systems Lab.
SPACE-VARIANT PROCESSING USING PHASE CODES AND FOURIER-PLANE SAMPLING TECHNIQUES Interim Report
Rangachar Kasturi 1 Jun. 1980 158 p refs
(Grant AF-AFOSR-0076-79)
(AD-A087285; AFOSR-80-0557TR; SR-1) Avail: NTIS HC A08/MF A01 CSCL 14/5

This report discusses alternative approaches to using multiplex holography representing space-variant optical systems. The first part of the report presents the results of extensive computer simulations used in evaluating the effectiveness of Gold codes in encoding the multiple reference beams required in a sampled input/multiple reference beam realization of a space-variant system. The second part considers a totally different approach which samples the input plane and the transfer function plane. This latter approach eliminates crosstalk entirely, but requires multiple copies of the sampled input function during the playback step. The results of preliminary experiments conducted to evaluate this alternative approach for representing space-variant systems holographically are presented, including experiments verifying the coherent addition of the multiplexed holograms on playback using computer-multiplexed holograms. GRA

N80-31780# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
ADAPTATION OF A KRATKY CAMERA TO USE WITH A ONE DIMENSIONAL POSITION SENSITIVE DETECTOR
Ryong-Joon Roe, J. C. Chang, M. Fishkis, and J. J. Curro 1 Aug. 1980 34 p refs Submitted for publication
(Contract N00014-77-C-0376; NR Proj. 356-655)
(AD-A087523; TR-4) Avail: NTIS HC A03/MF A01 CSCL 14/5

A Kratky small-angle X-ray camera was modified so as to allow the use of a one dimensional position sensitive detector with it. The modification was designed in such a way that most of the calibrations, necessary for subsequent correction of the collected intensity data, can be performed with little alteration in the collimation geometry or the electronics settings. In particular, the calibration of the uniformity of detector efficiency can be performed by repeated vertical travel of the detector at a constant speed across a beam scattered from a sample. A much higher speed of data collection, with no increase in the background noise nor any loss in the angular resolution, has been achieved in comparison to a regular Kratky camera operating in step-scanning mode. The practical utility of combining the PSD with a Kratky camera for studies of isotropic samples has been demonstrated. GRA

N80-31781# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
THE EFFECTS OF RADIATION ON MATERIALS. INSTRUMENT DESIGN AND CALIBRATION [GLI EFFETTI DELLA RADIAZIONE NEI MATERIALI. PROGETTO E MESSA A PUNTO DI ALCUNE APPARECCHIATURE]
E. Caruso, F. Cristofori, L. Filoni, A. Gray, A. Decesare, and G. Vanoli Oct. 1979 70 p refs In ITALIAN; ENGLISH summary
(CISE-1524) Avail: NTIS HC A04/MF A01

The design of an irradiation creep apparatus, the equipment for the automation of thermal treatments and of electrical resistivity measurements, and a magnetic susceptibility balance are described. These instruments are used to study the behavior of radiation damaged materials. An introduction concerning magnetic properties of materials is given. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-31782# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
OPTICAL AND DISCHARGE STUDIES OF NOVEL ELECTRONIC TRANSITION LASER SPECIES
Stephen R. Leone 4 Jan. 1980 19 p refs
(Contract N00014-77-C-0115; ARPA Order 2840)
(AD-A087123) Avail: NTIS HC A02/MF A01 CSCL 20/5

A new class of diatomic lasers has been developed by optical pumping. These lase on lines in the near ultraviolet and visible regions of the spectrum. Optical excitation studies show that these molecular systems have high efficiency, may be scalable to high average powers, are nondegradable, and offer promise for pumping by other excitation schemes, such as electric discharge. It is possible that one or more candidate systems in this category of lasers might be useful in generating blue-green radiation for underwater applications. Preliminary investigations with electric discharge excitation show good formation of glow dischargers in sulfur dimer vapor. Materials problems and the difficulties of high temperature discharge technology appear to be the major drawbacks in pursuing such studies further for laser action. GRA

N80-31783# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.
SHORT INTENSE SUBMILLIMETER PULSE GENERATION Final Report, 1 Jul. 1979 - 30 Jun. 1980
Thomas A. DeTemple Jul. 1980 27 p refs
(Contract DAAG29-79-C-0075)
(AD-A087421; UILU-ENG-80-2546; ARO-16751.2-P) Avail: NTIS HC A03/MF A01 CSCL 20/5

The use of a mode-locked CO2 laser for an optically pumped near millimeter wave source has been refined and extended to the generation of pulses from C(13)H3F at 1.22mm. More refined theoretical estimates illustrate the transient nature of the conversion process in both space and time and set approximate limits on the ultimate pulse duration to be about one-half that of the pump. The implications are that one is not limited by the intrinsic linewidth in producting short pulse and that significant conversion may occur in modest distances, of order meters, suggesting quasi-compact sources for further experiments. GRA

N80-31784# Cober Electronics, Inc., Stamford, Conn.
HIGH VOLTAGE NANOSECOND PULSE GENERATOR Interim Technical Report, 1 May - 31 Oct. 1979
C. Zavales Jul. 1980 19 p
(Contract DAAB07-77-C-2641; DA Proj. 1L7-62705-AH-94)
(AD-A087291; DELET-TR-77-2641-5; IR-5) Avail: NTIS HC A02/MF A01 CSCL 14/2

A parallel Blumlein circuit, combined with a spark gap switch, was designed for operation at 24 kV, 5,000 A peak. Tests were conducted with a single Blumlein with a 10 ohm load. Because of problems with breakdown in the triggered spark gap, a slightly larger spark gap was substituted. An acceptable pulse is delivered from the pulse forming network after adjustment of the inductive elements in the network. GRA

N80-31785# Stanford Univ., Calif. Edward L. Ginzton Lab.
RESEARCH STUDIES ON RADIATIVE COLLISION LASERS Final Technical Report, 10 Mar. 1977 - 9 Jan. 1980
S. E. Harris and J. F. Young Jun. 1980 37 p refs
(Contract F19628-77-C-0072; AF Proj. 2306)
(AD-A087714; SU-GL-3090; RADC-TR-80-172) Avail: NTIS HC A03/MF A01 CSCL 20/5

This final report reviews the results of a program of theoretical and experimental studies of the physics and applications of radiative collisional processes involving two atoms and a photon simultaneously. GRA

N80-31788# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
QUASICONTINUUM PHYSICS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1980
Eli Yablonovitch and N. Bloembergen Jul. 1980 74 p refs
(Contract N00014-78-C-0531)

(AD-A087822) Avail: NTIS HC A04/MF A01 CSCL 20/8

Polyatomic molecules are prepared in highly excited vibrational states by short high intensity CO2 laser pulses. The excited state is probed by a second infrared pulse, or by visible fluorescence. An apparatus involving two independently tunable infrared pulses permits time resolved infrared spectroscopy intramolecular interactions. Visible infrared double pulse experiments permit the study of quasi-continuum vibrational absorption in an electronically excited state of the molecule. GRA

N80-31787# RCA Labs., Princeton, N. J.

INJECTION LASER MODE STUDIES Final Report, 18 Apr. 1977 - 17 Apr. 1980

H. S. Sommers, Jr. Jun. 1980 30 p refs

(Contract DAAG29-77-C-0021)

(AD-A087522; PRRL-80-CR-23; ARO-14755.11-EL) Avail: NTIS HC A03/MF A01 CSCL 20/5

This document is the sixth semiannual report and the final report of a basic study of the modes of injection lasers. The concern is the fundamental relationship between the modal properties of diode lasers, their structure, and the nature of the electrical drive. The semiannual report features three pioneering studies: The development of an equation of state relating the laser power, spectrum, and beam profile to the input current and laser structure; the behavior of the laser on transition of threshold as the current is increased through the immediate vicinity of threshold; and the comparison of the laser spectrum under pulsed drive to excitation with a dc current. It also touches on the behavior of quarternary lasers operating at 1.2 micrometers. The report concludes with a consideration of the outstanding fundamental problem at the present time, the dynamic interaction of the laser which reduces the number of spectral lines in the coherent output of a laser as the current drive is increased.GRA

N80-31788# California Univ., Livermore. Lawrence Livermore Lab.

PROPERTIES OF LOW-INDEX LASER MATERIALS

Marvin J. Weber 9 May 1980 7 p refs Presented at the Topical Conf. on Basic Opt. Properties of Mater., Gaithersburg, Md., 5-7 May 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-84399; CONF-800552-1) Avail: NTIS HC A02/MF A01

Measurements of n sub 2 for a large class of oxide and fluoride crystals and glasses were made using 100 ps, 1.06 micrometer laser pulses and time resolved interferometry. Values of n sub 2 for various glasses are summarized. DOE

N80-31789# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.

MEASURING FEATURES OF THE FLUENCE AT THE FAR FIELD OF CO2 PULSED LASER: AN ISSUE STUDY WITH SUGGESTIONS ON HOW TO DO IT

Eric G. Johnson, Jr., Robert J. Phelan, Jr., and Don R. Boyle Apr. 1980 56 p refs

(PB80-191141; NBSIR-80-1628) Avail: NTIS HC A04/MF A01 CSCL 20F

Measuring the energy density incident on targets where the energy is from a pulse of high energy at CO2 wavelengths and where the targets are located at the far field is discussed. The analysis considers a ground based target for testing and calibration of the measurement systems and a drone towed behind an airplane from which the energy distribution information is telemetered to the ground station. Each stage of the measurement system from the reception of the incident laser pulse on the drone to the pulse coded transmission of the sampled data to a ground based computer is described. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-31790* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FREE-PISTON REGENERATIVE HOT GAS HYDRAULIC ENGINE Patent

Donald G. Beremand, inventor (to NASA) Issued 5 Aug. 1980 7 p Filed 12 Oct. 1978 Supersedes N79-10426 (17 - 12, p 0057)

(NASA-Case-LEW-12274-1; US-Patent-4,215,548; US-Patent-Appl-SN-950876; US-Patent-Class-60-520; US-Patent-Class-417-383) Avail: US Patent and Trademark Office CSCL 13I

A displacer piston which is driven pneumatically by a high-pressure or low-pressure gas is included in a free-piston regenerative hydraulic engine. Actuation of the displacer piston circulates the working fluid through a heater, a regenerator and a cooler. The present invention includes an inertial mass such as a piston or a hydraulic fluid column to effectively store and supply energy during portions of the cycle. Power is transmitted from the working fluid to a hydraulic fluid across a diaphragm or lightweight piston to achieve a hydraulic power out-put. The displacer piston of the present invention may be driven pneumatically, hydraulically or electromagnetically. In addition, the displacer piston and the inertial mass of the present invention may be positioned on the same side of the diaphragm member or may be separated by the diaphragm member.

Official Gazette of the U.S. Patent and Trademark Office

N80-31791 Princeton Univ., N. J.

AXISYMMETRIC FLOW FIELDS IN MOTORED AND FIRING SPARK-IGNITION ENGINES Ph.D. Thesis

Juan Ignacio Ramos 1980 206 p

Avail: Univ. Microfilms Order No. 8019829

The axisymmetric, turbulent flow field in both motored and firing engines was modeled by using a modified version of the k/e model which introduces the compressibility effects in the Reynolds stresses. The conservation equations were integrated along computational control-volumes and were solved by an inversion of tridiagonal matrices. A global perturbation technique was incorporated in the continuity and energy equations to accelerate the convergence of the flow field. The valve was simulated as an infinitely thin plate, which remains either fixed or for a two-stroke cycle, or moves in a specified manner for a four-stroke cycle. For the motored engine, only a single gas, namely air, was considered. Results show that characteristics of the fluid dynamical held for a firing engine are similar to those of motored engine; however, in the former case, there is a higher rate of heat transfer from the mixture to the cylinder walls. Dissert. Abstr.

N80-31792 California Univ., Irvine.

LYAPUNOV STABILITY OF MULTI-MACHINE POWER SYSTEMS Ph.D. Thesis

Yuan Kuan Chen 1980 193 p

Avail: Univ. Microfilms Order No. 8019686

The stability of multi-machine power systems is investigated by means of the Decomposition-Aggregation method. The power system is decomposed into low order subsystems, each of which consist of an isolated subsystem and an interconnection. The stability of each isolated subsystem is studied using Barbasin's method in terms of its stability region and stability measures. Using these stability measures and constraints on the interconnection of the subsystems, an aggregated model of the overall system is formed. The stability criterion of the overall system can be established by examining the negative definiteness of an aggregated matrix. If this matrix is of the Metzler type and if negative diagonal quasidominance is satisfied, then the matrix is a negative definite matrix, and in turn, the stability of the overall system is guaranteed. Linear programming is utilized to determine the optimum weighting given to each subsystem in the overall Lyapunov function so that the least restrictive stability region for the overall system is obtained. Dissert. Abstr.

N80-31793 Polytechnic Inst. of New York.

AN INVESTIGATION TO MEASURE INTERPARTICLE FRICTION AND TO DETERMINE IMPORTANT MATERIAL AND ENVIRONMENTAL VARIABLES WHICH INFLUENCE THIS FRICTION Ph.D. Thesis

Jones Samuel Adeniyi 1980 171 p

Avail: Univ. Microfilms Order No. 8019382

The effects of humidity, temperature and lubricants on the frictional properties of iron, copper and graphite powders, plaster,

and Portland cement were investigated using a newly designed dynamic friction measuring apparatus. The results show that in both metal powders, friction decreased as the humidity increased. This decrease in friction reached a minimum at some optimum amount of humidity, then as the humidity increased beyond optimum value, friction increased. This optimum value of humidity is not the same for all the powders. There is very little of temperature on the friction of both iron and copper powders. The addition of mineral oil as a lubricant shows that the friction is reduced at low temperature but increased gradually to some maximum as the temperature increased above the room temperature and then dropped to a new value. In the case of plaster and Portland cement, the friction increased, with increasing humidity up to a certain maximum and then dropped again. Dissert. Abstr.

N80-31794*# Battelle Columbus Labs., Ohio.
SSME TURBOPUMP BEARING ANALYTICAL STUDY Final Report
J. W. Kannel and T. Merriman 20 Aug. 1980 33 p refs
(Contract NAS8-33576)
(NASA-CR-161554) Avail: NTIS HC A03/MF A01 CSCL 13I

Three shuttle pump bearings operating under severe overspeed and shut-down conditions are evaluated. The specific parameters investigated include outer race stresses, cage stresses, cage-race drag, bearing heating, and crush loading. A quasi-dynamic version of the BASDAP computer code was utilized which involved the calculation of ball-race forces (inner and outer), contact pressures, contact dimensions, and contact angles as a function of (1) axial load, (2) radial load, and (3) centrifugal load on the bearing. Generally, radial loads on the order of 13,300 N (3000 pounds) per bearing or 26,700 N (6000 pounds) per bearing pair, could be expected to cause severe problems to any of the bearings with a 17,800 N (4000 pounds) axial load. Further, when possible temperature excursions are considered, even a load of 8900 N (2000 pounds) may be excessive. However, high momentary radial loads with a 3800 N (850 pounds) axial load would not be anticipated to cause catastrophic failure of the fuel pump bearing. M.G.

N80-31795*# Eaton Corp., Southfield, Mich. Engineering and Research Center.
SMALL PASSENGER CAR TRANSMISSION TEST; FORD C4 TRANSMISSION Final Report
M. P. Bujold Jun. 1980 383 p
(Contracts DEN3-124; EC-77-A-31-1044)
(NASA-CR-159881; ERC-LIB-8060; DOE/NASA/0124-2) Avail: NTIS HC A17/MF A01 CSCL 13I

A 1979 Ford C4 automatic transmission was tested per a passenger car automatic transmission test code (SAE J651b) which required drive performance, coast performance, and no load test conditions. Under these test conditions, the transmission attained maximum efficiencies in the mid-eighty percent range for both drive performance tests and coast performance tests. The major results of this test (torque, speed, and efficiency curves) are presented. Graphs map the complete performance characteristics for the Ford C4 transmission. A.R.H.

N80-31796*# Eaton Corp., Southfield, Mich. Engineering and Research Center.
SMALL PASSENGER CAR TRANSMISSION TEST; CHEVROLET LUV TRANSMISSION Final Report
M. P. Bujold Jun. 1980 428 p
(Contract DEN3-124; EC-77-A-31-1044)
(NASA-CR-159882; ERC-LIB-80121; DOE/NASA/0124-3) Avail: NTIS HC A19/MF A01 CSCL 13I

A 1978 Chevrolet LUV manual transmission tested per the applicable portions of a passenger car automatic transmission test code (SAE J65lb) which required drive performance, coast performance, and no load test conditions. Under these test conditions, the transmission attained maximum efficiencies in the upper ninety percent range for both drive performance tests and coast performance tests. The major results of this test (torque, speed, and efficiency curves) are presented. Graphs map the complete performance characteristics for the Chevrolet LUV transmission. A.R.H.

N80-31797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATION AND VISUALIZATION OF FACE SEAL MOTION STABILITY BY MEANS OF COMPUTER GENERATED MOVIES
I. Etsion and B. M. Auer 1980 19 p refs Proposed for presentation at the Fluid Sealing Conf., Leeuwenhorst, Holland, 1-3 Apr. 1980; sponsored by the British Hydrodynamic Research Assoc.
(NASA-TM-81581; E-554) Avail: NTIS HC A02/MF A01 CSCL 13I

A computer aided design method for mechanical face seals is described. Based on computer simulation, the actual motion of the flexibly mounted element of the seal can be visualized. This is achieved by solving the equations of motion of this element, calculating the displacements in its various degrees of freedom vs. time, and displaying the transient behavior in the form of a motion picture. Incorporating such a method in the design phase allows one to detect instabilities and to correct undesirable behavior of the seal. A theoretical background is presented. Details of the motion display technique are described, and the usefulness of the method is demonstrated by an example of a noncontacting conical face seal. M.G.

N80-31798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OBSERVATION OF PRESSURE VARIATION IN THE CAVITATION REGION OF SUBMERGED JOURNAL BEARINGS
I. Etsion and L. P. Ludwig 1980 27 p refs Proposed for presentation at the Lubrication Conf., New Orienas, 11-14 Oct. 1981; sponsored by the ASME
(NASA-TM-81582; E-555) Avail: NTIS HC A03/MF A01 CSCL 13I

Visual observations and pressure measurements in the cavitation zone of a submerged journal bearing are described. Tests were performed at various shaft speeds and ambient pressure levels. Some photographs of the cavitation region are presented showing strong reverse flow at the downstream end of the region. Pressure profiles are presented showing significant pressure variations inside the cavitation zone, contrary to common assumptions of constant cavitation pressure. Author

N80-31799# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
A METHODOLOGY FOR MODELING CONFINED, TEMPERATURE SENSITIVE CUSHIONING SYSTEMS
Virginia P. Kobler Jun. 1980 162 p refs
(AD-A087351; AD-E950004; DRSMI-RL-80-10) Avail: NTIS HC A08/MF A01 CSCL 13/4

A methodology for modeling the impact response of a confined cushioning system has been demonstrated. Data for modeling were acquired from test drops made with a test specimen comprised of a plywood cube (protected item) within a cleated plywood shipping container, under controlled environmental conditions, utilizing 2 inch Minicel as the cushioning system. Individual curves were developed for each temperature and drop height for both the interior box and total container system. Utilizing a stepwise regression procedure, a general model was developed for the interior box and also for the total container system. The general model permits the cushion designer to predict the impact response of a container system within drop heights of 12 to 30 inches, a temperature range of -65 F to 160 F, and a static stress range of 0.088 to 1.255 psi. GRA

N80-31800# Pennsylvania State Univ., University Park. Applied Research Lab.
THRUSTING CHARACTERISTICS OF PROPULSORS
W. S. Gearhart and E. P. Bruce 30 May 1980 33 p refs
(Contract N00024-79-C-6043)
(AD-A087281; ARL/PSU-TM-80-118) Avail: NTIS HC A03/MF A01 CSCL 13/10

The function of any propulsive system, is to provide a forward thrust along its axis. The design objective is to obtain a maximum in propulsor thrust with a minimum of shaft power while satisfying practical limits of propulsor size, shaft speed, and cavitation resistance. The generation of thrust requires that some kinetic energy be lost in the propulsive slipstream. These losses

are associated with both axial and rotational velocity components in the slipstream. In addition, the presence of rotational velocity in the slipstream results in a low pressure region in the far wake which reduces the net effective thrust generated by the propulsor. It has been the tradition of the propulsor designer to neglect the rotational effects, other than considering the kinetic energy losses, since it is assumed that the rotational component of velocity in the far wake is small. This assumption is valid for propulsors that ingest large mass flows and place a small amount of energy per unit mass in the flow. However, the trend now is toward more heavily loaded propulsors, both of the open or ducted type. Thus, a reevaluation of the relative magnitudes of the losses associated with the velocity components in the propulsive slipstream is necessary. It is the intent of this paper to evaluate, for a given shaft power, the relative losses in propulsor thrust associated with the axial and rotational velocity components in the slipstream. GRA

N80-31801# Columbia Univ., New York. Tribology and Lubrication Research Lab.
EXPERIMENTAL INVESTIGATION OF HYDRODYNAMIC SELF-ACTING GAS BEARINGS AT HIGH KNUDSEN NUMBERS Final Report, 1977 - 1980
Yiao-Tee Hsia and Gerald A. Domoto 1 Jul. 1980 157 p refs
(Contract N00014-75-C-0552; NR Proj. 062-491)
(AD-A087400; FR-28) Avail: NTIS HC A08/MF A01 CSCL 13/9

This investigation gives experimental confirmation of the 'slip flow' theory, developed by Burgdorfer, for modelling hydrodynamic gas bearing with clearances below 0.25 micrometers. An interferometric technique using two CW lasers is used to measure the small clearances with an 0.025 micrometer accuracy. The pitch and roll angles of the slider bearing and the surface contour of the slider are also measured interferometrically. The effects of molecular rarefaction are studied by operating the bearing in different gas media with different mean free paths. Air is used to study Knudsen numbers below 0.5 while helium is used to study Knudsen numbers above 0.5. Experimentally measured trailing edge clearances and pitch angles are compared with theoretical predictions using the 'modified' Reynolds equation with velocity slip boundary conditions. The modified Reynolds equation is solved numerically using two different numerical algorithms. Excellent agreement between experiment and theory is found for clearances as high as 1.60 micrometers to as low as 0.075 micrometers with corresponding ambient Knudsen number of 0.04 and 2.51, respectively. GRA

N80-31802# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 1: FLEXIBLE ROTOR DYNAMICS Interim Report, Apr. 1976 - Nov. 1979
C. H. T. Pan, E. R. Wu, and A. I. Krauter AFAPL Wright-Patterson AFB, Ohio Jun. 1980 370 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A087806; SRC-78-TR-27-Pt-1; AFAPL-TR-78-6-Pt-1)
Avail: NTIS HC A16/MF A01 CSCL 01/3

This report describes an update of the Air Force computer programs concerned with the dynamics of high speed rotors. The new program, which replaces AFAPL/SFL Programs No. 100, 101, and 117, has the capability to perform a variety of rotordynamics analyses. These analyses include torsional vibration and bending vibration. The bending analyses consist of those for critical speeds, unbalance response, asynchronous response, and rotor stability. In addition, the program incorporates the following: a formulation based on whirl coordinates with an exact bending solution between rotor modelling stations, the capability to utilize a small subset of these stations in much of the calculations, a set of bearing characteristics that depend on rotor speed and vibration frequency and that include anisotropy and damping, and an economical combination of a separate rotor analysis and the characteristics of the bearings. The report includes: an introduction to use of the program as well as a detailed user's manual, an overview of the mathematical basis of the program and a complete presentation of those mathematics. GRA

N80-31803# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. des Systemes Balistiques et Spatiaux.
BISTABLE SOLENOID VALVE, VOLUME 1 Final Report [ELECTROVANNE BISTABLE A VERROUILLAGE]
B. Gosse 24 Jul. 1979 108 p In FRENCH
(Contract ESTEC-2946/76-NL-AK)
(MU/LR-97.091/79-Vol-1; ESA-CR(P)-1306-Vol-1) Avail: NTIS HC A06/MF A01

The specification, design, test procedures and results for a solenoid valve are presented. The bistable valve is to be used in pneumatic circuits up to 300 bars and in hydrazine circuits in aerospace applications. Total weight is less than 0.25 kg. Pressure drop is less than 0.1 bar for 10 g/s hydrazine flow or 1 g/s nitrogen flow. A position detection device based on hall effect cells is included. The test results show that the design is appropriate for space use. Comments are made on the admissible pressure drop at satellite life end, on the maximum opening pressure when working with liquids, and the replacement of the hall effect position detector by a shock detector device. Author (ESA)

N80-31804# National Centre of Tribology, Risley (England). European Space Tribology Lab.
[ACTIVITIES OF THE EUROPEAN SPACE TRIBOLOGY LABORATORY FOR 1979] Progress Report
E. J. Robbins Feb. 1980 14 p refs Original contains color illustrations
(Contract ESA-2584/75-MD)
(ESA-ESTL-44; ESA-CR(P)-1342) Avail: NTIS HC A02/MF A01

Solar array drive mechanism tests, tilt mechanism tests, development of test techniques, development of solid lubricants for ball bearings, calculations of ball bearing torque and stiffness, slip-ring developments, and studies on relative lubricities of oils in vacuum are discussed. Four out of thirty requests for consulting involved small experimental programs which are summarized. Author (ESA)

N80-31663 Kobe Univ. (Japan).
STABILITY PROBLEMS OF ROTOR SYSTEMS
T. Iwatsubo *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 3-8 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-31805# General Dynamics Corp. Fort Worth, Tex. Structural and Design Dept.
DURABILITY METHODS DEVELOPMENT, VOLUME 1, PHASE 1: SUMMARY Final Technical Report, Apr. 1978 - Jun. 1979
S. D. Manning, W. R. Garver, S. P. Henslee, J. W. Norris, B. J. Pendley, S. M. Spesker, V. D. Smith, B. G. W. Yee, M. Shinozuka (Modern Analysis, Inc., Ridgewood, N. J.), and J. N. Yang (George Washington Univ., Washington, D.C.) Wright-Patterson AFB, Ohio AFFDL Sep. 1979 113 p refs
(Contract F33615-77-C-3123; AF Proj. 2401)
(AD-A087301; FZM-657-Vol-1; AFFDL-TR-79-3118-Vol-1)
Avail: NTIS HC A06/MF A01 CSCL 13/5

A summary is presented of an analytical methodology developed to meet USAF durability requirements. Details are given in four companion volumes. Analytical approaches that are currently used or have potential to be used to determine economic life are surveyed. Results of a structural survey of durability problems experienced at USAF ALC's are summarized. Durability critical parts criteria and economic life criteria are discussed. An analytical method to determine the crack population in a structure as a function of service-time is presented. Fastener-hole cracking is the basic form of damage analyzed.

Representations of initial quality and growth of small cracks are discussed. The effect of inspection and repair on the distribution of cracks is included. GRA

N80-31808# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF NONDESTRUCTIVE GAMMA-RAY AND NEUTRON TECHNIQUES FOR THE SAFEGUARDING OF IRRADIATED FUEL MATERIALS
J. R. Phillips, J. K. Halbig, D. M. Lee, S. E. Beach, T. R. Bement, E. Dermendjiev, C. R. Hatcher, K. Kaieda, and E. C. Medina May 1980 89 p refs
(Contract W-7405-eng-36)
(LA-8212) Avail: NTIS HC A05/MF A01

Nondestructive gamma ray and neutron techniques were used to characterize the irradiation exposures of irradiated fuel assemblies. Techniques for the rapid measurement of the axial activity profiles of fuel assemblies were developed using ion chambers and Be(gamma, n) detectors. Detailed measurements using high resolution gamma ray spectrometry and passive neutron techniques were correlated with operator declared values of cooling times and burnup. DOE

N80-31807# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
REASSESSMENT OF SERVICE LIFE BY COMPARATIVE SPECIMEN TESTS
J. B. deJonge 23 Feb. 1979 20 p refs Presented at 10th ICAF Symp., Brussels, 16-18 May, 1979 Sponsored by Netherlands Research Branch of the Directorate of Materials Air (NLR-MP-79008-U) Avail: NTIS HC A02/MF A01

Various aspects of aircraft service life reassessment are discussed in light of the fact that the actual load experience of aircraft may deviate appreciably from design assumptions. Life assessment procedures using comparative fatigue tests on speciments are described for the F-5 aircraft used by the Royal Netherlands Air Force specimens were developed representing critical areas using the same material and heat treatment, same grain direction, surface treatment, and same bolt type.
Author (ESA)

N80-31808# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1977 - May 1979
Guy E. Habercom, Jr. Jun. 1980 288 p
(PB80-811821) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

A bibliography containing 220 abstracts is presented. Ultrasonic equipment and techniques for nondestructive inspection/testing of materials and fabrication processes are investigated. GRA

N80-31809# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1979 - May 1980
Guy E. Habercom, Jr. Jun. 1980 102 p Supersedes NTIS/PS-79/0635; NTIS/PS-78/0566
(PB80-811839; NTIS/PS-79/0635; NTIS/PS-78/0566) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

A bibliography containing 94 abstracts is presented. Ultrasonic equipment and techniques for nondestructive inspection/testing of materials and fabrication processes are investigated. GRA

N80-31810# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1978 - May 1979
Guy E. Habercom, Jr. Jun. 1980 267 p Supersedes NTIS/PS-78/0568; NTIS/PS-77/0404
(PB80-811847; NTIS/PS-78/0568; NTIS/PS-77/0404) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

A bibliography containing 259 abstracts is presented addressing ultrasonic equipment and techniques for nondestruction inspection/testing of materials and fabrication processes. GRA

N80-31811# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jun. 1979 - May 1980
Guy E. Habercom, Jr. Jun. 1980 221 p Supersedes NTIS/PS-79/0637; NTIS/PS-78/0568
(PB80-811854; NTIS/PS-79/0637; NTIS/PS-78/0568) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Ultrasonic equipment and techniques for nondestruction inspection/testing of materials and fabrication processes are investigated in these reports obtained from worldwide literature. This updated bibliography contains 213 abstracts, all of which are new entries to the previous edition. GRA

N80-31812# Transportation Systems Center, Cambridge, Mass.
DETERMINATION OF TIRE QUALITY FROM NONDESTRUCTIVE INSPECTION Final Report, Sep. 1975 - Mar. 1979
S. N. Bobo Nov. 1979 65 p
(PB80-185358; DOT-TSC-NHTSA-79-30; DOT-HS-804-828) Avail: NTIS HC A04/MF A01 CSCL 13F

Capability of an ultrasonic nondestructive inspection system to identify the groups with a high propensity to failure is described. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-31813 Michigan Univ., Ann Arbor.
A NEW METHOD FOR THE SOLUTION OF ANISOTROPIC THIN PLATE BENDING PROBLEMS Ph.D. Thesis
Benjamin Chin-wen Wu 1980 137 p
Avail: Univ. Microfilms Order No. 8020753

The indirect boundary integral method which uses the Green's function of a clamped circular plate of isotropic material was modified to solve an isotropic thin plate problem. Three major modifications introduced are (1) the set of fictitious moments are replaced by an additional set of fictitious forces, and the entire set of fictitious forces is located outside of the embedded contour; (2) the numerical integration is replaced by a simple summing process; and (3) the Green's function for a clamped circular plate is replaced by the Green's function of an infinite plate. With these modifications, significant improvements in solution accuracy and computing efficiency have been achieved. The second order singularity difficulties associated with free edges are avoided, and due to the simplicity of the new method, the computing costs are reduced by about sixty percent. Since the Green's functions for orthotropic and anisotropic infinite plates are also available, the new method is readily extended to orthotropic and anisotropic thin plate bending problems.
Dissert. Abstr.

N80-31814 Idaho Univ., Moscow.
ELASTIC-PLASTIC FRACTURE ANALYSIS OF TYPE 304 STAINLESS STEEL FLAT-PLATE AND PIPE SECTIONS CONTAINING SURFACE FLAWS Ph.D. Thesis
Walter Graham Reuter 1980 376 p
Avail: Univ. Microfilms Order No. 8019794

Thirty-six (36) flat-plate specimens, each containing a surface flaw of either rectangular, triangular, or ellipsoidal configuration, were tested to instability. Data collected consisted of load, cross head displacement, crack-opening displacement, strain gage, acoustic emission, reflective photoelasticity, stop-action photography, and motion pictures. Analytical techniques were developed to predict conditions for initiation of subcritical crack growth, for the defect to penetrate the 6.4 mm(0.25 in.) wall thickness, and for instability. The capabilities of the analytical techniques are compared with test results obtained from nine (9) pipe

specimens. The pipe specimens contained triangular-shaped surface flaws that were oriented with the defect length in the axial direction. The pipe specimens were hydrostatically loaded until the defect penetrated the wall thickness. Based on test results of this program it is possible to accurately predict from flat-plate specimen tests the conditions required for a defect to penetrate the wall thickness of a pipe. Dissert. Abstr.

N80-31815 Notre Dame Univ., Ind.
DYNAMIC BUCKLING OF INELASTIC SPHERICAL SHELLS Ph.D. Thesis
Glen Eugene Funk 1980 359 p
Avail: Univ. Microfilms Order No. 8020980

The dynamic inelastic buckling of the complete spherical shell having mechanical properties characterized by a strain rate potential is investigated. Both bilinear elastic-plastic and Ramberg-Osgood uniaxial stress-strain relationships are considered. A minimum principle is employed to develop the equations of perturbed motion in functional form. In addition to the quadratic terms, cubic and quartic terms are retained in the functional to observe the magnitude of motion at which these terms become significant. An unloading criterion is developed and a generalized deflection measure is introduced. A first order difference formulation is employed to solve the system of equations. Numerical results obtained for initial velocity or impulse loading indicate that motions can become unstable prior to the critical time indicated by the quasibifurcation criterion. The results are attributed to the variation of the perturbed motion stress-strain relations with time arising from the equal biaxial stress state associated with the unperturbed motion. Dissert. Abstr.

N80-31816 Polytechnic Inst. of New York.
CRITICAL EXCITATIONS FOR LINEAR AND NONLINEAR STRUCTURAL SYSTEMS Ph.D. Thesis
Aristodimos J. Philippacopoulos 1980 74 p
Avail: Univ. Microfilms Order No. 8019409

Seismic assessment of structures is discussed. The basis for this assessment lies in the concept of the critical excitation which is generated by combining a properly selected set of recorded ground motions together with a maximization procedure. It is a site as well as system dependent excitation. Both 'linear' and 'nonlinear' were considered. For the nonlinear case a linearization technique based on the concept of equivalent linearization was employed. 'Critical response spectra' were constructed by generating critical excitations for a range of spectral frequencies. Finally a 'simulated critical excitation' was generated in order to extend the concept of critical excitation. This means that a single input may be employed for all the design variables of a particular structure. From the applications it is concluded that the seismic assessment of structures based on critical excitations leads to results which are conservative to a certain degree. However this conservatism is fully justifiable for 'socially or economically important structures', which generally require high confidence level of reliability for their seismic assessment. Dissert. Abstr.

N80-31817 Michigan State Univ., East Lansing.
ELASTIC BUCKLING OF ARCHES BY FINITE ELEMENT METHOD Ph.D. Thesis
Jose Gregorio Lange 1980 186 p
Avail: Univ. Microfilms Order No. 8020717

The elastic buckling load of arches were computed by representing an arch by beam finite elements curved in one plane but deformable in three dimensional space. The equilibrium equation was obtained from the first variation of the potential energy. To avoid dealing with nonlinear equations, an estimate of the buckling load was obtained by assuming that the displacement increased linearly with the applied load until buckling occurs. A computer program was prepared for the implementation of the linear equilibrium solution and the buckling load solutions. Numerical results were obtained involving arc ribs with in-plane and out-of-plane behavior. The types of buckling problems considered are: in-plane, out-of-plane, tilted loads, and the effect of out-of-plane horizontal loads on the inplane buckling load. Results indicate that while a small out-of-plane horizontal load may have little effect on the inplane buckling load, the latter decreases rapidly with increases in the horizontal load.
Dissert. Abstr.

N80-31818# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FURTHER EXPERIMENTAL STUDIES ON VIBRATIONS AND BUCKLING OF ECCENTRICALLY LOADED STIFFENED CYLINDRICAL SHELLS
J. Singer and Y. Segal Dec. 1978 46 p refs
(TAE-331) Avail: NTIS HC A03/MF A01

A method for detection of load eccentricity of stringer-cylindrical shells from vibration tests developed earlier was applied to shells with prescribed load eccentricity. Seven shells with outward or zero load eccentricity were tested and analyzed. In the tests, the shells were vibrated at different load levels and finally buckled. The experimental and theoretical results verify the methods of load eccentricity identification and buckling load prediction and extend their applicability. Author

N80-31819# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE UTILITY OF PLANE STRAIN APPROXIMATIONS FOR OBLIQUE IMPACT COMPUTATIONS
J. A. Zukas, G. H. Jonas, and J. J. Misey Oct. 1979 39 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A081120; ARBRL-MR-02969) Avail: NTIS HC A03/MF A01 CSCL 20/11

The feasibility of using the plane strain mode of a 2D code in lieu of a 3D code for this oblique kinetic energy penetration problem was determined. First, a comparison in a normal impact problems was made between the axisymmetric and the plane strain modes of the two dimensional HELP code. A volumetric relationship was given for the kinetic energy and the axial momentum of the projectile, but data scaling for other variables of the projectile and those of the target were not determined. Next, HELP in the plane strain mode was utilized to solve a long rod impact at 60 deg. obliquity and the results were compared with experimental data. The oblique impact problem was also modeled with a three dimensional version of the EPIC code. A comparison of rod loss penetration depth, and penetrator and target profiles revealed very good agreement, at early times when the penetrator density was greater than that of the target.
A.R.H.

N80-31820*# Lockheed-Georgia Co., Marietta.
DESIGN AND ANALYSIS OF A STIFFENED COMPOSITE FUSELAGE PANEL
J. N. Dickson and S. B. Biggers Aug. 1980 51 p refs
(Contract NAS1-15949)
(NASA-CR-159302; LG80ER0137) Avail: NTIS HC A04/MF A01 CSCL 20L

The design and analysis of stiffened composite panel that is representative of the fuselage structure of existing wide bodied aircraft is discussed. The panel is a minimum weight design, based on the current level of technology and realistic loads and criteria. Several different stiffener configurations were investigated in the optimization process. The final configuration is an all graphite/epoxy J-stiffened design in which the skin between adjacent stiffeners is permitted to buckle under design loads. Fail safe concepts typically employed in metallic fuselage structure have been incorporated in the design. A conservative approach has been used with regard to structural details such as skin/frame and stringer/frame attachments and other areas where sufficient design data was not available. M.G.

N80-31821# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
LOCAL APPROACH TO PROBLEMS OF FATIGUE CRACK GROWTH
H. Fuhring 1979 11 p refs Transl. into ENGLISH from Sitzung des Arbeitskreises Betriebsfestigkeit (Stuttgart), 1979 p 509-518
(ICAF-1143) Avail: NTIS HC A02/MF A01

Fatigue fracture mechanics attempts to express crack growth as a function of local quantity, either the cyclic strain variation or the range of the stress intensity factor above the crack opening level, so that the damage is reduced to a few pure fatigue mechanisms. This approach to crack growth problems permits the introduction of data resulting from any confirmed knowledge of material behavior (environmental effects, hardening, softening,

three dimensional plasticity effects, etc.). Fundamental studies interpreting the role of crack closure on crack growth are reviewed. These consider constant amplitude crack tip stress and strain states as well as crack surface displacements under variable amplitude loading. A computer program was developed for calculating the load sequences and for deriving the N curve. Predictions using only basic structural and material data vary by a factor of plus or minus 2 compared with experiments. A.R.H.

N80-31822# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
EFFICIENT COMPUTATIONAL TECHNIQUES FOR THE ANALYSIS OF SOME PROBLEMS OF FRACTURE IN PRESSURE VESSELS AND PIPING Interim Report
T. Nishioka and Satya N. Atluri Jun. 1980 30 p refs
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087225; GIT-CACM-SNA-20; TR-4) Avail: NTIS HC A03/MF A01 CSCL 20/11

Results of (1) a numerical investigation, based on an energy consistent moving-singularity dynamic finite element procedure, of fast crack propagation in a finite plate; (2) numerical simulation of experimental data on fast crack propagation and arrest in a double-cantilever-beam specimen; and (3) stress-intensity factor solutions in a thermally shocked cylindrical vessel containing an inner surface (meridional) elliptical flaw, are presented. Comparison of these results with other available solutions, and pertinent discussions, are included. GRA

N80-31823# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
DYNAMIC FRACTURE ANALYSIS: A TRANSLATING-SINGULARITY FINITE ELEMENT PROCEDURE Interim Report
Satya N. Atluri and T. Nishioka Jun. 1980 10 p refs Submitted for publication
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087226; GIT-CACM-SNA-2; TR-6) Avail: NTIS HC A02/MF A01 CSCL 20/11

In this paper an efficient finite element method, which accounts for the translating singularities near the tip of a dynamically propagating crack, is presented. Two aspects of analyses of dynamic fracture, namely, (1) determination of dynamic stress intensity factors from given crack velocity history; and (2) determination of crack velocity history (and arrest) from given dynamic fracture toughness versus crack velocity data are considered. Results are presented and discussed for wedge loaded rectangular, as well as tapered, double cantilever beam specimens. GRA

N80-31824# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
NEW GENERAL AND COMPLEMENTARY ENERGY THEOREMS, FINITE STRAIN, RATE-SENSITIVE INELASTICITY, AND FINITE ELEMENTS: SOME COMPUTATIONAL STUDIES Interim Report
Satya N. Atluri and H. Murakawa 1980 20 p Submitted for publication
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087227; GIT-CACM-SNA-23; TR-7) Avail: NTIS HC A02/MF A01 CSCL 20/11

General variational theorems for the rate problems of rate-dependent finite strain inelasticity, in terms of the appropriate rates of the first and second Piola-Kirchhoff stress tensors, the symmetrized Biot-Lure: stress tensor, and their conjugate measures of strain-rate are discussed. Certain new rate-complementary-energy principles, involving the rate of spin and the rate of the symmetrized Biot-Lure: stress tensor as variables, are stated for finite strain analysis of rate-sensitive materials, such as those exhibiting elasto-visco-plastic and creep behavior. Uniqueness and stability criteria for those inelastic solids, using the finite element counterparts of the new complementary energy rate principles, are discussed. Computational studies, using the complementary energy methods, discussed herein incude: (1) bifurcation necking and post-buckling analyses of initially perfect elasto-plastic bars and (2) post-buckling and large-deformation analyses of thin elastic plates under inplane compression and transverse bending loads. GRA

N80-31825# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
NUMERICAL MODELING OF DYNAMIC CRACK PROPAGATION IN FINITE BODIES, BY MOVING SINGULAR ELEMENTS. PART 2: RESULTS Interim Report
T. Nishioka and Satya N. Atluri Jun. 1980 29 p refs
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087228; GIT-CACM-SNA-25; TR-9) Avail: NTIS HC A03/MF 01 CSCL 20/11

Using the moving-singularity finite element method described in Part 1 of this paper, several problems of dynamic crack propagation in finite bodies have been analysed. Discussions of the effects of wave interactions on the dynamic stress-intensity factors are presented. The obtained numerical results are compared with the corresponding infinite domain solutions and other available numerical solutions for finite domains. GRA

N80-31826# General Dynamics Corp. Fort Worth, Tex.
FATIGUE BEHAVIOR OF ADHESIVELY BONDED JOINTS, VOLUME 1 Final Technical Report, Jul. 1976 - Apr. 1980
John Romanko and W. G. Knauss Wright-Patterson AFB, Ohio AFML Apr. 1980 193 p refs 2 Vol.
(Contract F33615-76-C-5220; AF Proj. 7340)
(AD-A087280; AFWAL-TR-80-4037-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 11/1

The fatigue behavior of adhesively bonded aluminum joints was investigated analytically and experimentally. Stress distributions in the adhesive interlayer were calculated to guide planning of the joint tests and the interpretation of the test results. Finite element stress analyses were conducted using a linear elastic, and a three element linear viscoelastic model for the adhesive behavior. Thick adherend lap shear specimens of the model joint configuration were fabricated and tested. These specimens were instrumented and subjected to sinusoidal fatigue tests at several frequencies, humidities and temperatures. Certain tests were interrupted at various stages and the specimens examined for fatigue damage. Damage was found to initiate in the calculated high stress regions, and to propagate with further load cycling. Observations and recommendations resulting from the investigation are included in this final report. GRA

N80-31827# General Dynamics Corp. Fort Worth, Tex.
FATIGUE BEHAVIOR OF ADHESIVELY BONDED JOINTS. VOLUME 2: APPENDICES Final Technical Report, Jul. 1976 - Apr. 1980
John Romanico and W. G. Knauss Wright-Patterson AFB, Ohio AFML Apr. 1980 78 p refs 2 Vol.
(Contract F33615-76-C-5220; AF Proj. 7340)
(AD-A087360; AFWAL-TR-80-4037-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 11/1

The fatigue behavior of adhesively bonded aluminum joints was investigated analytically and experimentally. Stress distributions in the adhesive interlayer were calculated to guide planning of the joint tests and the interpretation of the test results. Finite element stress analyses were conducted using a linear elastic, and a three element linear viscoelastic model for the adhesive behavior. Thick adherend lap-shear specimens of the model joint configuration were fabricated and tested. These specimens were instrumented and subjected to sinusoidal fatigue tests at several frequencies, humidities and temperatures. Certain tests were interrupted at various stages and the specimens examined for fatigue damage. Damage was found to initiate in the (calculated) high stress regions, and to propagate with further load cycling. Observations and recommendations resulting from the investigation are included in this final report. GRA

N80-31828# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
ON CRACK PROPAGATION ALONG CRYSTALLOGRAPHIC SLIP BANDS
K. S. Chan and D. A. Koss Jun. 1980 8 p refs Presented at the Acta/Scripta Metallurgica Conf. on Dislocation Modeling, Gainesville, Fla., 22-27 Jun. 1980
(Contract N00014-76-C-0037)
(AD-A087128; TR-13) Avail: NTIS HC A02/MF A01 CSCL 20/11

The influence of the crystallography of slip (fcc, hcp, and bcc) on crack propagation along planar slip bands is examined

for two different inclined-crack configurations. If a crack propagates along a slip band and the Burger's vector of slip within that band is contained in the plane of the crack, (i.e., coplanar slip), then non-coplanar slip is hindered and large normal stresses develop near the crack-tip even for inclined cracks. The magnitude of these normal stresses is largest for basal plane cracking in a hcp material. However, the calculations show that the magnitude of the plastic constraint factor even for an inclined crack in fcc and bcc alloys fracturing along crystallographic slip bands is also large and comparable to a mode I crack in a polycrystalline material. The combination of the intense shear caused by the planar slip and the large normal stresses should result in easy crack propagation across individual grains and could result in a susceptibility to hydrogen embrittlement. GRA

N80-31829# Naval Ship Research and Development Center, Bethesda, Md.

DETERMINATION OF FATIGUE DAMAGE Research and Development Report

R. N. Pangborn (Pennsylvania State Univ.), T. Tsakalakos (Rutgers Univ.), W. F. Mayo (Rutgers Univ.), S. Weissman (Rutgers Univ.), and I. R. Kramer Aug. 1980 37 p refs

(AD-A087442; DTNSRDC-80/093) Avail: NTIS HC A03/MF A01 CSCL 11/6

The deformation response of polycrystalline AA2024-T4 to cyclic loading has been determined by conventional and double crystal diffractometry. These studies show a preferential work hardening near the surface compared to the bulk. The defect distribution as a function of depth was also investigated as a function of the fraction of fatigue life. From these studies, it was determined that the remaining fatigue life could be predicted by determining the average ratio beta/beta^{o} where beta is the linewidth at any number of fatigue cycles and beta^{o} is the critical linewidth at fracture. Current studies have shown these predictions to be valid for tests where the stress amplitude is held constant for the entire test. A few tests have also been performed where the loading sequence is more complicated. In these tests, the X-ray predictive method was found to be far more accurate than conventional methods. GRA

N80-31830# Systems Research Labs., Inc., Dayton, Ohio.

TWO DIMENSIONAL LINEAR ELASTIC ANALYSIS OF FRACTURE SPECIMENS: USER'S MANUAL OF A FINITE ELEMENT COMPUTER PROGRAM Final Report

Jaleed Ahmad Wright-Patterson AFB, Ohio AFML Feb. 1980 117 p refs

(Contract F33615-79-C-5025)

(AD-A087440; AFWAL-TR-80-4008) Avail: NTIS HC A06/MF A01 CSCL 09/2

A Finite Element code for plane stress and plane strain linear elastic analysis of fatigue crack growth test specimen configurations was developed. A user's manual for the above code, along with user's manuals for a mesh plotting program, and mesh generating programs for compact, three point bend, and ring specimen geometries, is provided. Numerical examples for several specimen geometries are also included. GRA

N80-31831# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Mechanics Lab.

STINT/CD: A STAND-ALONE EXPLICIT TIME INTEGRATION PACKAGE FOR STRUCTURAL DYNAMICS ANALYSIS

Phillip G. Underwood and K. C. Park Jun. 1980 46 p refs (Contract N00014-74-C-0355)

(AD-A087423; LMSC-D770637) Avail: NTIS HC A03/MF A01 CSCL 13/13

This paper is a user's guide for the stand-alone explicit direct time integration package STINT/CD for structural dynamics analysis. STINT/CD uses an automatic variable time increment central difference method. The purpose, function, limitations, and usage of the package are described. A FORTRAN listing of STINT/CD is given along with a sample problem which illustrates its usage and performance. GRA

N80-31832# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

VIBRATION OF THICK RECTANGULAR PLATES OF BIMODULUS COMPOSITE MATERIAL

C. W. Bert, J. N. Reddy, W. C. Chao, and V. S. Reddy May 1980 30 p refs

(Contract N00014-78-C-0647; NR Proj. 064-609)

(AD-A087424; OU-AMNE-80-8) Avail: NTIS HC A03/MF A01 CSCL 11/4

A finite-element analysis is carried out for small-amplitude free vibration of laminated, anisotropic, rectangular plates having arbitrary boundary conditions, finite thickness-shear moduli, rotatory inertia, and bimodulus action (different elastic properties depending upon whether the fiber-direction strain is tensile or compressive). The element has five degrees of freedom, three displacements and two slope functions, per node. An exact closed-form solution is also presented for the special case of freely supported single layer orthotropic and two layer, cross-ply plates. This provides benchmarks to evaluate the validity of the finite-element analysis. Both solutions are compared with numerical results existing in the literature for special cases (all for ordinary, not bimodulus, materials) and good agreement is obtained. GRA

N80-31833# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

THERMAL BENDING OF THICK RECTANGULAR PLATES OF BIMODULUS COMPOSITE MATERIAL

J. N. Reddy, C. W. Bert, Y. S. Hsu, and V. S. Reddy Jun. 1980 32 p refs

(Contract N00014-78-C-0647; NR Proj. 064-609)

(AD-A087425; OU-AMNE-80-9) Avail: NTIS HC A03/MF A01 CSCL 11/4

Closed-form and finite-element solutions are presented for thermal bending and stretching of laminated composite plates. The material of each layer is assumed to be elastically and thermoelastically orthotropic and bimodular, i.e., having different properties depending upon whether the fiber-direction normal strain is tensile or compressive. The formulations are based on the thermoelastic version of the Whitney-Pagano laminated plate theory, which includes thickness shear deformations. Numerical results are obtained for deflections and neutral-surface positions associated with normal strains in both of the in-plane coordinates. The closed-form and finite-element results are found to be in good agreement. GRA

N80-31834# Akron Univ., Ohio. Inst. of Polymer Science.

DETACHMENT OF AN ELASTIC MATRIX FROM A RIGID SPHERICAL INCLUSION

A. N. Gent 1 Jul. 1980 23 p refs

(Contract N00014-78-C-0408; NR Proj. 092-555)

(AD-A087414; TR-8) Avail: NTIS HC A02/MF A01 CSCL 11/1

An approximate theoretical treatment is given for detachment of an elastomer from a rigid spherical inclusion by a tensile stress applied to the elastomeric matrix. The inclusion is assumed to have an initially debonded patch on its surface and the conditions for growth of the patch are derived from fracture energy considerations. Catastrophic debonding is predicted to occur at a critical applied stress when the initial debond is small. The strain energy dissipated as result of this detachment, and hence the mechanical hysteresis, are also evaluated. When a reasonable value is adopted for Young's modulus (E) of the elastomeric matrix, it is found that detachment from small inclusions, of less than abut 0.1 mm in diameter, will not occur, even when the level of adhesion is relatively low. Instead, rupture of the matrix near the inclusion becomes the preferred mode of failure at an applied stress given approximately by E/2. For still smaller inclusions, of less than about 1 micrometer in diameter, rupture of the matrix becomes increasingly difficult, due to the increasing importance of a surface energy term. These considerations account for the general features of reinforcement of elastomers. GRA

N80-31835# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.

NUMERICAL MODELING OF DYNAMIC PROPAGATION IN FINITE BODIES, BY MOVING SINGULAR ELEMENTS. PART 1: FORMULATION Interim Report

T. Nishioka and S. N. Atluri Jun. 1980 28 p refs

(Contract N00014-78-C-0636; NR Proj. 064-610)

(AD-A087395; GIT-CACM-SNA-24-Pt-1; TR-8) Avail: NTIS

HC A03/MF A01 CSCL 20/11

An efficient numerical (finite element) method is presented for the dynamic analysis of rapidly propagating cracks in finite bodies, of arbitrary shape, wherein linear-elastic material behavior and two dimensional conditions prevail. Procedures to embed analytical asymptotic solutions for singularities in stresses/strains near the propagating crack-tip, to account for the spatial movement of these singularities along with the crack-tip, and to directly compute the dynamic stress-intensity factor, are presented. GRA

N80-31836# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

THERMOELASTICITY OF CIRCULAR CYLINDRICAL SHELLS LAMINATED OF BIMODULUS COMPOSITE MATERIALS

Y. S. Hsu, J. N. Reddy, and C. W. Bert Jul. 1980 38 p refs (Contract N00014-78-C-0647)

(AD-A087429; OU-AMNE-80-14) Avail: NTIS HC A03/MF A01 CSCL 11/4

Closed-form and finite-element solutions are presented for the thermoelastic behavior of laminated composite shells. The material of each layer is assumed to be thermoelastically orthotropic and bimodular, i.e., having different properties depending upon whether the fiber-direction normal strain is tensile or compressive. The formulations are based on the thermoelastic generalization of Dong and Tso's laminated shell theory, which includes thickness shear deformations. The finite element used here has five degrees of freedom per node (three displacements and two bending slopes). Numerical results are presented for deflections and the positions of the neutral surfaces associated with bending along both coordinate directions. The closed-form and finite-element results are found to be in good agreement. GRA

N80-31837# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Metals Behavior Branch.

***AN EXPERIMENTAL WEIGHT FUNCTION METHOD FOR* STRESS INTENSITY FACTOR CALIBRATION M.S. Thesis. Interim Report, Jan. - Oct. 1979**

Dan Bar-Tikva Apr. 1980 93 p refs (AF Proj. 2307)

(AD-A087846; AFWAL-TR-80-4001) Avail: NTIS HC A05/MF A01 CSCL 20/11

The weight function procedure allows one to convert stress intensity factors K and crack displacement information obtained for one crack configuration and loading into the stress intensity factor solution for the same geometry and another loading. The feasibility of using the weight function idea for a two dimensional case with experimental results is demonstrated in this work. Mode 1 stress intensity factor K1 measurements obtained by a laser interferometric technique and crack mouth opening displacement measurements were taken for an edge cracked strip subjected to four point bending. These results were used to construct (numerically) a weight function with the aid of a computer program written for this purpose. Results of K1 for the same geometry with two different loading configurations, uniform tension and three point bending (with two different length to width ratios) were computed. These results agree favorably with the known solution and demonstrate that a set of experiments for a single loading can accurately predict the stress intensity factor for any other loading configuration of the same geometry. The advantage of the weight function method would be particularly important if these loading configurations are difficult or impossible to reproduce in the laboratory. GRA

N80-31838# Hanford Engineering Development Lab., Richland, Wash.

THERMOELASTIC BUCKLING OF PLATES IN A CYLINDRICAL GEOMETRY AGAINST AN ELASTIC BACK SUPPORT

L. D. Simmons (Portland Univ.) and R. W. Wierman 1980 17 p refs Presented at the Intern. Conf. on Thermal Stresses in Mater. and Struct. in Severe Thermal Environments, Blacksburg, Va., 19 Mar. 1980

(Contract EY-76-C-14-2170)

(HEDL-SA-2066-FP; CONF-800360-1) Avail: NTIS HC A02/MF A01

A plate which is fixed at its edges to a strong edge support structure will develop large compressive stresses when heated from ambient temperature more rapidly than the support structure. Determining the response of the plate to this situation requires stability analysis to ascertain whether the plate might buckle, or whether the constrained thermal expansion will lead to compressive stresses exceeding the yield point because it did not buckle. A special case, in which the plate is curved slightly into a cylindrical shape and the convex face of the plate is against a supporting surface, is considered. DOE

N80-31839# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

CRACK PROPAGATION IN HASTELLOY X

T. Weerasooriya and J. P. Strizak May 1980 39 p refs (Contract W-7405-eng-26)

(ORNL/TM-7255) Avail: NTIS HC A03/MF A01

The fatigue and creep crack growth rates of Hastelloy X were examined both in air and impure helium. Creep crack growth rate is higher in air and impure helium at 650 C. Initial creep crack growth from the original sharp fatigue crack is by an intergranular mode of fracture. As the cracking accelerates at higher stress intensities, growth is by a mixed mode of both intergranular and transgranular fracture. Fatigue crack growth rate increases with increasing temperature and decreasing frequency for the image of stress intensities reported in the literature and is lower in impure helium than in air. DOE

N80-31840# California Univ., Livermore. Lawrence Livermore Lab.

PLASTICITY UNDER COMBINED STRESS LOADING

Mark L. Wilkins and John E. Reaugh (Science Applications, Inc., San Leandro, Calif.) 8 Feb. 1980 8 p refs Presented at the ASME Pressure Vessels and Piping Technol. Conf., San Francisco, 12-15 Aug. 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-83322; CONF-800804-1) Avail: NTIS HC A02/MF A01

The stress-strain fields occurring in pressure vessels and pipes are, in general, combinations of tension and shear. Material specimens tested separately in simple tension and simple shear provide experimental data on the flow stress and failure conditions for these two limiting cases. Computer simulations of tension and torsion tests corresponding to experiments on aluminum 6061-T651 are presented. Aluminum is used as a first step for developing a method to study the plasticity and ductile fracture of reactor grade steel under combined stresses. It is noted that the flow stress differs for plastic flow in tension compared to torsion. A general flow-stress model is derived from the experiments. DOE

N80-31841# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

REMOTE MEASUREMENT OF CRACK GROWTH IN DOUBLE CANTILEVER BEAM (DCB) SPECIMENS

H. P. vanLeeuwen, L. Schra, and A. M. Otter 1979 62 p refs

(NLR-TR-79006-U) Avail: NTIS HC A04/MF A01

A method is suggested to determine crack length and load or load line crack opening displacement by measuring beam separation and free end rotation on extensions to the free ends of a double cantilever beam specimen. Application of the method to specimens with real stress crack corrosion cracks gave large discrepancies between crack lengths derived from calibration data for slits and crack lengths measured by direct observation of the specimen surface. Also, on the basis of a few calibration runs made on a specimen with a real crack, it is concluded that the calibration curves for specimens with slits may differ appreciably from those for specimens with real cracks. A discrepancy was noted between the relations of free end rotation to crack length observed between a specimen which was left to crack freely and a specimen which was recalibrated repeatedly during the test. Author (ESA)

N80-31842# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

MATHEMATICAL FORMULATION OF DAMPING FOR STRUCTURAL RESPONSE ANALYSIS

H. H. Ottens 27 Feb. 1979 12 p refs Presented at AGARD Specialist Meeting on Damping Effects in Aerospace Struct., Williamsburg, Va., 1-6 Apr. 1979

(NLR-MP-79010-U) Avail: NTIS HC A02/MF A01

A survey is presented of damping models that are commonly used in structural response analysis of aerospace structures. The models are evaluated with respect to the required knowledge of structural damping, the mathematical complexity, and the accuracy of the calculated response. The survey is limited to linear damping models and special attention was given to models which represent lightly damped structures. Author (ESA)

N80-31843# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

ANALYSIS OF AXIALLY LOADED STRINGER STIFFENED CIRCULAR CYLINDERS

Aake Samuelson and Peter Vestergren 1979 64 p refs (Contract FMV-F-FL-82223-78-002-21-001)

(FFA-TN-HU-2134) Avail: NTIS HC A04/MF A01

The available methods of analysis for the different possible modes of buckling of circular cylinders are summarized. It is concluded that densely stiffened cylinders behave in a way similar to that of an unstiffened shell and the methods of analysis available yield reasonably good agreement with test results. In sparsely stiffened cylinders the lower buckling load is governed by the behavior of the shell plate between the stiffeners. Recommendations for design calculations of different types of stiffened cylinders are given. Author (ESA)

N80-31844# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

BUCKLING OF CYLINDERS WITH LONGITUDINAL STIFFENERS SUBJECTED TO AXIAL COMPRESSION Final Report. M.S. Thesis - Royal Inst. of Technology, Stockholm

Hans Groth 1979 90 p refs (Contract FMV-F-FL-82223-78-174-21-001)

(FFA-TN-HU-2184) Avail: NTIS HC A05/MF A01

The cylinders were designed to buckle in the local buckling region in accordance with the theory for curved panels. This theory was supposed to give the best agreement with test results, but theories for plane plates were also compared to the test results. Eight, twelve, and twenty stringers were used and the end fixtures simulated nearly clamped elastic boundary conditions. The stringers could be considered as heavy. The specimens were not geometrically perfect. The purpose of the tests was to examine the buckling behavior of sparsely stringer stiffened cylinders manufactured with regular workshop tolerances. It was found that most of the available theories are suitable only for the unstiffened cylinder or the general instability cylinders. The only theory that is found for sparsely stiffened cylinders seems to be column theory, which gives an overly conservative design since the influence from the shell is not taken into account. Author (ESA)

N80-31845# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

EVALUATION AND COMPARISON OF NONDESTRUCTIVE SERVICE INSPECTION METHODS

E. A. B. deGraaf and P. DeRijk 17 Apr. 1979 10 p refs Presented at 9th World Conf. on Nondestructive Testing, Melbourne, Nov. 1979

(NLR-MP-79005-U) Avail: NTIS HC A02/MF A01

Fatigue cracks in 102 aluminum alloy specimens were inspected with eddy currents, ultrasonics, X-rays, and penetrants. The specimens were then corroded and the inspections repeated. Inspection results were verified by fractographic examination of the opened up fatigue cracks. It was found that: (1) excepting the use of penetrant before corrosion, long cracks were missed upon the application of five nondestructive testing (NDT) techniques both before and after corrosion under laboratory conditions; (2) inspection efficiency is governed by crack depth rather than crack length; (3) four out of five NDT techniques applied indicated a theshold length for crack detection; 4) for all the NDT methods the scatter with regard to accuracy increased with decreasing crack length; (5) although these techniques underestimated crack length, eddy current and ultrasonic inspections achieved the same accuracy both before and after corrosion; (6) the accuracy of penetrant inspection decreased significantly after corrosion;(7) sensitivity and probability of detection of all five NDT techniques decreased significantly after corrosion; and (8) before corrosion penetrant is the most reliable, sensitive, and accurate inspection method. After corrosion penetrant remains the most sensitive, but eddy current is more reliable. Author (ESA)

N80-31846# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

METHODS FOR THE INTERPOLATION AND THE EXTRAPOLATION OF THE RESULTS OF CREEP RUPTURE TESTS

H. P. vanLeeuwen 27 Feb. 1979 71 p In DUTCH; ENGLISH summary Presented at Meeting of the Creep Comm. of the Netherlands Soc. of Mater. Sci., Cleveland, 30 Mar. 1979

(NLR-MP-79007-U) Avail: NTIS HC A04/MF A01

A survey of extrapolation methods, graphic analysis, statistics and mathematical models relevant to creep rupture are presented. Minimal commitment and discrete function values, and creep diagrams are also discussed. Author (ESA)

N80-31847# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

FLIGHT SIMULATION FATIGUE CRACK PROPAGATION IN 7010 AND 7075 ALUMINUM ALLOY PLATE

R. J. H. Wanhill, W. G. J. tHart, and L. Schra May 1979 20 p refs

(NLR-MP-79019-U) Avail: NTIS HC A02/MF A01

The fatigue crack propagation resistances of 7010-T7651, 7010-T73651 and 7075-T7351 thick plate were compared for flight simulation (gust spectrum) loading conditions. The 7075-T7351 was slightly superior, and it was shown that this superiority was not essentially due to the higher fracture thoughness of this alloy. The influence of specimen thickness on the crack propagation resistance was significant. Thinner specimens gave longer crack propagation lives, generally lower crack propagation rates, and generally longer delays in crack growth following severe flights. Author (ESA)

N80-31848# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

ENVIRONMENTAL FATIGUE

R. J. H. Wanhill Jun. 1979 25 p refs Presented at Soc. of Met. Engr. Sem. on Metal Fatigue, Leuven, Belgique, Oct. 1979

(NLR-MP-79025-U) Avail: NTIS HC A02/MF A01

An overview of the environmental influences on fatigue crack initiation and propagation is given followed by a discussion of practical measures to alleviate and control the environmental contribution. These include design changes facilitating inspection and reducing fatigue and corrosion, surface protection, cathodic protection materials changes, the use of inhibitors, water displacing compounds, sealants, and barrier layers. Author (ESA)

N80-31849# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

THEORY AND CALCULATION OF VIBRATING STRUCTURES

Roger Valid 1980 58 p refs In FRENCH; ENGLISH summary Presented at CEA/EDF Conf. on Vibrations des Struct. dans le Domaine Ind., Jouy-en-Josas, France, 15-19 Oct. 1979 Report will also be announced as translation (ESA-TT-663)

(ONERA-P-1980-1) Avail: NTIS HC A04/MF A01

Finite element methods, linear vibration theory and the calculation of geometrically nonlinear structures are covered. Finite element methods are developed in a simple manner from the displacement method. Details are given about the most commonly used elements. The theory of linear vibrations is treated for the discrete case. Its variational properties are, however, recalled for both discrete and continuous cases. Formulas describing the response to various excitations (transient, harmonic, periodic, and random) are given. Variational form methods for calculating structures with geometrical nonlinearities are presented together with the algorithms most commonly used for arbitrary excitations. The stability of dynamic systems is introduced. Author (ESA)

N80-31850# National Technical Information Service, Springfield, Va.

FINITE ELEMENTS IN STRUCTURAL ANALYSIS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - May 1980

Brian Carrigan Jun. 1980 233 p Supersedes NTIS/PS-79/0706; NTIS/PS-78/0639
(PB80-811516; NTIS/PS-79/0706; NTIS/PS-78/0639) Avail: NTIS HC $30.00/MF $30.00 CSCL 20K

The bibliography cites Government sponsored research reports concerning finite element analysis as applied to structural mechanics problems. Some computer programs are mentioned, but for a more complete listing of software developed for structural problems, see the Published Searches titled structural mechanics software. This updated bibliography contains 222 abstracts, 68 of which are new entries to the previous edition. GRA

N80-31851# National Bureau of Standards, Washington, D.C. Measurement Lab.
FRACTURE CONTROL PRACTICES FOR METAL STRUCTURES
H. I. McHenry and S. T. Rolfe (Kansas Univ., Lawrence) Jan. 1980 115 p refs Sponsored in part by Naval Ship Research and Development Center
(PB80-185648; NBSIR-79-1623) Avail: NTIS HC A06/MF A01 CSCL 13M

Fracture control practices are the engineering procedures and requirements that contribute to the prevention of fracture in metal structures. These practices are identified as the elements of fracture control and each element is defined and described. The systematic application of these practices to the prevention of fracture in a particular structure is accomplished by either the code approach or the performance specification approach to fracture control. In these two approaches, the consideration given to each of the elements of fracture control is discussed and illustrated with examples for specific types of structures. Selected practices that may be of use in Naval systems are discussed. GRA

42 GEOSCIENCES (GENERAL)

N80-31852# Army Engineer Topographic Labs., Fort Belvoir, Va. Center for Remote Sensing.
EVALUATING SOIL MOISTURE AND TEXTURAL RELATIONSHIPS USING REGRESSION ANALYSIS Progress Report, Jan. - Jun. 1979
Melvin B. Satterwhite May 1980 35 p refs
(DA Proj. 4A1-61102-B-52C)
(AD-A087371; ETL-0226) Avail: NTIS HC A03/MF A01 CSCL 08/13

Soil moisture and textural conditions are described for 179 soil samples from an arid to semiarid climate. Stepwise multiple regression analysis of these data produced four regression equations that related (1) the percent sand and clay and (2) the percent fines, with the percent soil water held at 0.33 bar (FC) and the 15 bar (WP) potentials. Evaluation of these equations showed no differences between the estimates at the 0.33 bar potential using either the percent sand and clay or the percent fines. Better estimates for the WP were obtained when the percent sand and clay were used instead of the percent fines. The differences between the estimated soil moisture at FC or WP varied less than 30 percent from the measured soil moisture values for 161 (90 percent) of the 179 soil samples. The differences between the estimated and the measured soil moisture values were not significant at the 95 percent level of confidence. The regression equations provide a method by which the potential percent soil water held at the FC or WP can be estimated from soil textural data. The accuracy and precision of the results of applying these equations to soils of other areas has not been determined. It would seem, however, that they would be applicable in those instances where only general working estimates are needed. GRA

N80-31853# Ohio State Univ., Columbus. Dept. of Geodetic Science.
A WORLD VERTICAL NETWORK
Oscar L. Colombo Feb. 1980 70 p refs
(Contract F19628-79-C-0027; AF Proj. 2309)
(AD-A086011; DGS-296; SR-4; AFGL-TR-80-0077) Avail: NTIS HC A04/MF A01 CSCL 08/5

Gravimetric data, levelling, and precise position fixes using artificial satellites or the Moon could be combined to estimate the potential difference between benchmarks situated far apart to an accuracy of a few tenths of kgal m. This is substantially better than what can be obtained with tide gauges, which are affected by the stationary sea surface topography. A set of these benchmarks can link national and continental levelling nets into a unified World Vertical Network. GRA

N80-31854# Geological and Economic Survey, Morgantown, West Va.
INORGANIC GEOCHEMISTRY OF DEVONIAN SHALES IN SOUTHERN WEST VIRGINIA: GEOGRAPHIC AND STRATIGRAPHIC TRENDS
Michael Ed Hohn, Ronald W. Neal, and J. J. Renton Apr. 1980 41 p refs
(Contract EY-76-C-05-5199)
(DOE-METC/5199/7) Avail: NTIS HC A03/MF A01

Samples of cuttings from twenty-one wells and a core from a single well in southern West Virginia were analyzed for major and minor elements: silicon, aluminum, iron, magnesium, calcium, sodium, titanium, phosphorus, manganese, sulfur, zinc, and strontium. Stratigraphic and geographic controls on elemental abundances were studied through canonical correlations, factor analyses, and trend surface analysis. The most abundant elements, silicon and aluminum, show gradual trends through the stratigraphic column of most wells, with silicon increasing and aluminum decreasing upsection. Other elements such as calcium, sulfur, and titanium change abruptly in abundance at certain stratigraphic boundaries. Important geographic trends run east-west: for instance, one can see an increase in sulfur and a decrease in titanium to the west; and a decrease in silicon from the east to the central part of the study area, then an increase further west. DOE

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-31855* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY (ISSUE 26)
Jul. 1980 118 p
(NASA-SP-7041(26)) Avail: NTIS HC $10.50 CSCL 05B

This bibliography lists 480 reports, articles, and other documents introduced into the NASA scientific and technical information system between April 1, 1980 and June 30, 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. A.R.H.

N80-31856*# National Aeronautics and Space Administration, Washington, D. C.
A DESCRIPTION OF A SYSTEM OF PROGRAMS FOR MATHEMATICALLY PROCESSING ON UNIFIED SERIES (YeS) COMPUTERS PHOTOGRAPHIC IMAGES OF THE EARTH TAKEN FROM SPACECRAFT
V. G. Zolotukhin, B. I. Kolosov, D. A. Usikov, V. I. Borisenko, S. T. Mosin, and V. N. Gorokhov Jun. 1980 29 p refs Transl. into ENGLISH of "Opisaniye systemy Programm Mathematicheskoy Obrabutki na EVM Yedinoy Serii (ES) Fotograficheskikh Apparatov (Kompleks SOFI)", Rept. Pr-336 Acad. of Sci. USSR, Inst. of Space Research, Moscow, 1977 p 1-30 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow

(Contract NASw-3198)
(NASA-TM-76208; Pr-336) Avail: NTIS HC A03/MF A01 CSCL 14E

A description of a batch of programs for the YeS-1040 computer combined into an automated system for processing photo (and video) images of the Earth's surface, taken from spacecraft, is presented. Individual programs with the detailed discussion of the algorithmic and programmatic facilities needed by the user are presented. The basic principles for assembling the system, and the control programs are included. The exchange format within whose framework the cataloging of any programs recommended for the system of processing will be activated in the future is displayed. T.M.

N80-31857*# National Aeronautics and Space Administration, Washington, D. C.
RADUGA EXPERIMENT: MULTIZONAL PHOTOGRAPHING THE EARTH FROM THE SOYUZ-22 SPACECRAFT
Ya. Ziman, Yu. Chesnokov, B. Dunayev, V. Aksenov, V. Bykovskiy, R. Ioskhim, K. Myuller, V. Choppe, and V. Volter Jul. 1980 27 p refs Transl. into ENGLISH of "Eksperiment Raduga--Mnogozonal Noye Fotografirovan ye Zemli s Kosmicheskogo Korablya Soyuza-22" Rept D-254 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-35 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76234; D-254) Avail: NTIS HC A03/MF A01 CSCL 14E

The main results of the scientific research and "Raduga" experiment are reported. Technical parameters are presented for the MKF-6 camera and the MSP-4 projector. Characteristics of the obtained materials and certain results of their processing are reported. L.F.M.

N80-31858*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
STATE ESTIMATION AND ABSOLUTE IMAGE REGISTRATION FOR GEOSYNCHRONOUS SATELLITES
Richard S. Nankervis, David W. Koch, and Henry M. Sielski (Computer Sciences Corp.) May 1980 16 p refs Presented at the Conf. of the Am. Congr. on Surv. and Mapping and Am. Soc. of Phot., St. Louis, 9-14 Mar. 1980
(Contract NAS5-24350)
(NASA-TM-80712) Avail: NTIS HC A02/MF A01 CSCL 14E

Spacecraft state estimation and the absolute registration of Earth images acquired by cameras onboard geosynchronous satellites are described. The basic data type of the procedure consists of line and element numbers of image points called landmarks whose geodetic coordinates, relative to United States Geodetic Survey topographic maps, are known. A conventional least squares process is used to estimate navigational parameters and camera pointing biases from observed minus computed landmark line and element numbers. These estimated parameters along with orbit and attitude dynamic models are used to register images, using an automated grey level correlation technique, inside the span represented by the landmark data. In addition, the dynamic models can be employed to register images outside of the data span in a near real time mode. An important application of this mode is in support of meteorological studies where rapid data reduction is required for the rapid tracking and predicting of dynamic phenomena. Author

N80-31859# Army Engineer Topographic Labs., Fort Belvoir, Va.
ERRORS IN AUTOMATIC PASS POINT MENSURATION USING DIGITAL TECHNIQUES
Michael A. Crombie Jun. 1980 22 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A087443; ETL-0232) Avail: NTIS HC A02/MF A01 CSCL 08/2

A technique for automatically measuring pass points from digital stereo images is evaluated. Numerical estimates of x-parallax and y-parallax for a specific stereo pair of images is presented as a function of terrain relief. GRA

N80-31860# Army Engineer Topographic Labs., Fort Belvoir, Va.
TERRAIN ANALYST SYNTHESIZER STATION
Gunther Schwarz Jun. 1980 28 p
(DA Proj. 4A7-62707-A-855)
(AD-A087370; ETL-0231) Avail: NTIS HC A03/MF A01 CSCL 08/2

This report describes the Terrain Analyst Synthesizer Station built under contract for USAETL. Tests were performed to determine the characteristics and adherence to the specifications set forth in the Purchase Description. GRA

N80-31861# California Univ., Livermore. Lawrence Livermore Lab.
SIMPLIFIED GROUNDWATER FLOW MODELING: AN APPLICATION OF KALMAN FILTER BASED IDENTIFICATION
K. D. Pimentel, J. V. Candy, S. G. Azevedo, and T. A. Doerr May 1980 13 p refs Presented at the Intern. Federation of Inform. Process. Working Conf. on Simulation and Environ., Bangor, Wales, 18-20 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82649; CONF-7909138-1) Avail: NTIS HC A02/MF A01

Groundwater contaminant transport models are needed in risk assessments for licensing and regulating long-term nuclear waste repositories. Groundwater flow rather than contaminant transport was considered because the flow problem is more simple. A pump-drawdown test is modeled with a reduced-order set of ordinary differential equations obtained by differencing the partial differential equation. The accuracy of the reduced model was determined by comparing it with the analytic solution for the drawdown test. An accuracy requirement of 2 percent error which was established at the single observation well and a model with only 21 states which was established satisfied that criterion. That model was used in an extended Kalman filter with synthesized measurement data from one observation well to identify transmissivity within 1 percent error and storage coefficient within 10 percent error. Several statistical tests used to assess the performance of the estimator/identifier found it to be satisfactory for this application. DOE

N80-31862# Rockwell International Corp., Richland, Wash. Energy Systems Group.
LANDSAT DATA AS A BASIS FOR REGIONAL ENVIRONMENTAL ASSESSMENT WITHIN THE COLUMBIA PLATEAU
L. S. Leonhart and J. G. Stephan (Battelle Pacific Northwest Labs., Richland, Wash.) May 1980 19 p Presented at the 6th Can. Symp. on Remote Sensing, Halifax, Canada, 21-23 May 1980
(Contract DE-AC06-77RL-01030)
(RHO-BWI-SA-43; CONF-800577-1) Avail: NTIS HC A02/MF A01

An environmental assessment is being performed in conjunction with siting a radioactive waste terminal-storage facility within the federally operated Hanford Site in south-central Washington. Initial assessments involved classification of four contiguous LANDSAT scenes recorded over the region and about 300 high-altitude (U-2) photographs. The resulting mosaic was segregated into ten land-cover classes. The classified land-cover data were then machine-integrated with digital irrigation well-location data. The resulting groundwater multi-source data product was required by hydrologists to segregate potential artificial recharge areas from artificial groundwater discharge areas. Related studies employed LANDSAT data and aerial imagery to identify linear structures and other geologic features which may have a significant bearing on the tectonic and/or hydrological setting of the Columbia Plateau. DOE

N80-31863# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
SENSORS FOR REMOTE SENSING [SENSORI PER TELERILEVAMENTO]
E. M. Bastida, F. Gardossi, A. Sona, F. Svelto, and V. Svelto Jan. 1979 53 p refs In ITALIAN; ENGLISH summary
(CISE-N-190) Avail: NTIS HC A04/MF A01

The most important remote sensing methods are discussed. Particular attention is devoted to the sensors, defined as the components transforming the electromagnetic information into

usable data. Photographic methods, radar and microwave methods, and applications of infrared and laser radiation are included.
Author (ESA)

N80-31864# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF LANDSAT MULTISPECTRAL SCANNER DATA TAPES
A. H. Benny London HMSO Feb. 1980 37 p refs
(RAE-TR-80018; RAE-Space-574; BR73767) Avail: NTIS HC A03/MF A01

A detailed study is described of a number of computer compatible magnetic tapes containing LANDSAT multi-spectral scanner (MSS) data. The differences between raw and corrected data tapes are shown along with the conversion process. It also shows the differences between the existing and a new form of corrected data tape. A computer program was written to enable raw data desirable for certain computer analyses to be obtained from the existing stocks of corrected data tapes. Author (ESA)

N80-31865# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Digitale Bildverarbeitung.
COMPARATIVE EXPERIMENTAL STUDY ON THE USE OF ORIGINAL AND COMPRESSED MULTISPECTRAL LANDSAT DATA FOR APPLIED RESEARCH
Klaus A. Ulbricht Feb. 1980 81 p refs Original contains color illustrations
(Contract ESTEC-3569/78-NL-HP(SC))
(DFVLR-FB-80-03; ESA-CR(P)-1343) Avail: NTIS HC A05/MF A01

Parts of two multispectral LANDSAT scenes, compressed by ratio 6.4 to 1, were investigated to determine the effect of the compression on the image contents. The LANDSAT image of the Bayuda desert in Sudan was submitted to supervised maximum likelihood classification before and after compression of data as a function of the rejection class parameter sigma. Different approaches as to the use of circular or rectangular training areas for classification on original and compressed scene served to investigate the influence of compression on image contents. Partitioning of classified image is given on a percentage basis as a function of sigma. Three dimensional clusters of spectral channels and histograms show the influence of compression. The heavy population of blue green algae on LANDSAT scene of the baltic of August 7, 1975, was another example used to test the influence of data compression. Three dimensional clusters of grey values of spectral channels of the investigated area and histograms show influence of compression. The effects of compression on partitioning of classified scences, are displayed in several tables and figures. Author (ESA)

N80-31866# Environmental Research Lab., Duluth, Minn. Large Lakes Research Station.
RESULTS OF A JOINT USA/USSR HYDRODYNAMIC AND TRANSPORT MODELING PROJECT, APPENDICES B, C, AND D Final Report, May - Dec. 1977
John F. Paul, William L. Richardson (Hydrochemical Inst., USSR), Alexander B. Grostko (Rostov State Univ., USSR), and Anton A. Matveyev Sep. 1979 252 p refs
(PB80-187529; EPA-600/3-79-101) Avail: NTIS HC A12/MF A01 CSCL 08H

Three geographical areas were modeled. The modeling approaches ranged from those employing material and mass conservation to describe water movement to those involving solution of the complete three dimensional hydrodynamic equations. The modeling calculations were compared to available data and, in all cases, reasonable agreement was obtained. GRA

N80-31867# Kansas Water Resources Research Inst., Manhattan.
SIMULATION OF RESERVOIR AND LAKE SEDIMENTATION Project Completion Report, Jul. 1973 - Jun. 1975
William M. Merrill Apr. 1980 158 p refs
(Contract DI-14-31-0001-4085)
(PB80-182801; CONTRIB-215; W80-05010; OWRT-B-036-KAN(1)) Avail: NTIS HC A08/MF A01 CSCL 08H

Two lakes were used to develop a model of reservoir sedimentation and two computer programs to simulate it. Basis for the model is a statement of general relationships formulated to describe sedimentation in shallow marine basins, modified to apply to relatively small freshwater bodies. In its modified form, the statement serves as foundation for quantitative and semiquantitative expressions that are translated into algorithms to simulate reservoir processes. The model and programs are appropriate only for reservoirs established on alluvial streams in which an essentially unlimited supply of sediment, 90 percent or more of which is silt and clay and at least 30 percent of which is clay of two microns or less, can be assured. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see *also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation.*

N80-31868 California Univ., Davis.
SOLAR DOMESTIC HOT WATER SYSTEM, A COMPARATIVE STUDY AND STORAGE TANK INVESTIGATION Ph.D. Thesis
Marvin Francis Young 1980 291 p
Avail: Univ. Microfilms Order No. 8019006

A computer program was developed to simulate five typical solar domestic hot water systems which included both thermosyphon and pumped designs that were assembled and tested. Numerical simulations of these systems were verified by comparison to experimental results. Predicted thermal performance, i.e., collector inlet and outlet temperatures, and auxiliary energy requirements were found to be in excellent agreement with experiments. The computer program was then used to predict the long term annual performance of the various systems at 14 different locations throughout California. Load size and load distribution were also varied. Economic analyses were performed on each system with the goal of identifying the most economical system at each location under a prescribed load (gallons/day) size and distribution pattern (time of day for hot water use). It was found that in almost all cases the two tank thermosyphon system was the most cost effective system for all locations, load sizes and distributions and shows promise of being the most widely used solar domestic hot water system.
Dissert. Abstr.

N80-31869*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 3: ENERGY CONVERSION SYSTEM CHARACTERISTICS Final Report
Jan. 1980 283 p refs
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159761; DOE/NASA/0030-80/3-Vol-3; UTC-FCR-1333-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 10B

Six current and thirty-six advanced energy conversion systems were defined and combined with appropriate balance of plant equipment. Twenty-six industrial processes were selected from among the high energy consuming industries to serve as a frame work for the study. Each conversion system was analyzed as a cogenerator with each industrial plant. Fuel consumption, costs, and environmental intrusion were evaluated and compared to corresponding traditional values. The advanced energy conversion technologies indicated reduced fuel consumption, costs, and emissions. Fuel energy savings of 10 to 25 percent were predicted compared to traditional on site furnaces and utility electricity. With the variety of industrial requirements, each advanced technology had attractive applications. Fuel cells indicated the greatest fuel energy savings and emission reductions. Gas turbines and combined cycles indicated high overall annual savings. Steam turbines and gas turbines produced high estimated returns.

In some applications, diesels were most efficient. The advanced technologies used coal derived fuels, or coal with advanced fluid bed combustion or on site gasifications. Data and information for both current and advanced energy conversion technology are presented. Schematic and physical descriptions, performance data, equipment cost estimates, and predicted emissions are included. Technical developments which are needed to achieve commercialization in the 1985-2000 period are identified. R.K.G.

N80-31870*# General Electric Co., Philadelphia, Pa. Thermal Power Systems Engineering.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 3: INDUSTRIAL PROCESSES Final Report
W. B. Palmer, H. E. Gerlaugh, and R. R. Priestley Apr. 1980 478 p Sponsored by DOE
(Contract DEN3-31)
(NASA-CR-159767; DOE/NASA/0031-80/3-Vol-3; GE80ET0104-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 10B

Cogenerating electric power and process heat in single energy conversion systems rather than separately in utility plants and in process boilers is examined in terms of cost savings. The use of various advanced energy conversion systems are examined and compared with each other and with current technology systems for their savings in fuel energy, costs, and emissions in individual plants and on a national level. About fifty industrial processes from the target energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. An attempt was made to use consistent assumptions and a consistent set of ground rules specified by NASA for determining performance and cost. Data and narrative descriptions of the industrial processes are given. R.K.G.

N80-31871*# California Univ., Los Angeles.
SILICON SOLAR CELL FABRICATION TECHNOLOGY Final Report
O. M. Stafsudd 15 May 1980 37 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954902)
(NASA-CR-163394; JPL-9950-386; DOE/JPL-954902) Avail: NTIS HC A03/MF A01 CSCL 10A

Device fabrication and photoconductive lifetime decay measurements were used to characterize single and polycrystalline silicon substracts. The device characterization of the processed materials was done by spectral response measurements and absolute quantum efficiency at a single wavelength. The results were then reduced to yield the diffusion length of the various samples. The photoconductive lifetime decay method was implemented in order to determine the minority carrier lifetime in unprocessed wafers. T.M.

N80-31872*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION FOR ELCAM-TEMPE, TEMPE, ARIZONA AND ELCAM-SAN DIEGO, SAN DIEGO, CALIFORNIA Final Report
Jun. 1980 102 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161492) Avail: NTIS HC A06/MF A01 CSCL 10A

The long term economic performance of the solar energy system at its installation site is analyzed and four additional locations selected to demonstrate the viability of the design over a broad range of environmental and economic conditions. The economic analysis of the solar energy systems that were installed at Tempe, Arizona and San Diego, California, is developed for these and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f Chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life: life cycle savings; year of positive savings; and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. The results demonstrate that the solar energy system is economically viable at all of the sites for which the analysis was conducted. R.K.G.

N80-31873*# AeroChem Research Labs., Inc., Princeton, N. J.
DEVELOPMENT OF A MODEL AND COMPUTER CODE TO DESCRIBE SOLAR GRADE SILICON PRODUCTION PROCESSES Final Report, 21 Sep. 1977 - 30 Sep. 1979
R. K. Gould and R. Srivastava Dec. 1979 126 p refs Sponsored in part by DOE
(Contract JPL-954862)
(NASA-CR-163515; AeroChem-TP-392; JPL-954862-79/8) Avail: NTIS HC A07/MF A01 CSCL 10A

Two computer codes were developed for describing flow reactors in which high purity, solar grade silicon is produced via reduction of gaseous silicon halides. The first is the CHEMPART code, an axisymmetric, marching code which treats two phase flows with models describing detailed gas-phase chemical kinetics, particle formation, and particle growth. It can be used to described flow reactors in which reactants, mix, react, and form a particulate phase. Detailed radial gas-phase composition, temperature, velocity, and particle size distribution profiles are computed. Also, deposition of heat, momentum, and mass (either particulate or vapor) on reactor walls is described. The second code is a modified version of the GENMIX boundary layer code which is used to compute rates of heat, momentum, and mass transfer to the reactor walls. This code lacks the detailed chemical kinetics and particle handling features of the CHEMPART code but has the virtue of running much more rapidly than CHEMPART, while treating the phenomena occurring in the boundary layer in more detail. L.F.M.

N80-31874*# AeroChem Research Labs., Inc., Princeton, N. J.
SILICON HALIDE-ALKALI METAL FLAMES AS A SOURCE OF SOLAR GRADE SILICON Final Report
D. B. Olson, W. J. Miller, and R. K. Gould Jan. 1980 75 p refs Sponsored in part by DOE
(Contract JPL-954777)
(NASA-CR-163514; Aerochem-TP-395; JPL-954777-80/8) Avail: NTIS HC A04/MF A01 CSCL 10A

The feasibility of using continuous high-temperature reactions of alkali metals and silicon halides to produce silicon in large quantities and of suitable purity for use in the production of photovoltaic solar cells was demonstrated. Low pressure experiments were performed demonstrating the production of free silicon and providing experience with the construction of reactant vapor generators. Further experiments at higher reagent flow rates were performed in a low temperature flow tube configuration with co-axial injection of reagents and relatively pure silicon was produced. A high temperature graphite flow tube was built and continuous separation of Si from NaCl was demonstrated. A larger scaled well stirred reactor was built. Experiments were performed to investigate the compatability of graphite based reactor materials of construction with sodium. At 1100 to 1200 K none of these materials were found to be suitable. At 1700 K the graphites performed well with little damage except to coatings of pyrolytic graphite and silicon carbide which were damaged. L.F.M.

N80-31875*# Sanders Associates, Inc., Nashua, N. H. Energy Systems Center.
SMALL SOLAR ELECTRIC SYSTEM COMPONENTS DEMONSTRATION Final Report
Aug. 1980 123 p Original contains color illustrations
(Contract JPL-955279)
(NASA-CR-163513) Avail: NTIS HC A06/MF A01 CSCL 10A

The design and testing of high temperature thermal storage modules (TSM) are reported. The test goals were to demonstrate the thermocline propagation in the TSM, to measure the steepness of the thermocline, and to measure the effectiveness of the

TSM when used in a Brayton system. In addition, a high temperature valve suitable for switching the TSM at temperatures to 1700 F is described and tested. Test results confirm the existence of a sharp thermocline under design conditions. The thermal profile was steeper than expected and was insensitive to air density over the range of the test conditions. Experiments were performed which simulated the airflow of a small Brayton engine, 20 KWe, having a pair of thermal storage modules acting as efficient recuperators. Low pressure losses, averaging 12 inches of water, and high effectiveness, 93% for a 15 minute switching cycle, were measured. The insulation surrounding the ceramic core limited thermal losses to approximately 1 KWt. The hot valve was operated over 100 cycles and performed well at temperatures up to 1700 F. M.G.

N80-31876*# Solarex Corp., Rockville, Md.
PILOT LINE REPORT: DEVELOPMENT OF A HIGH EFFICIENCY THIN SILICON SOLAR CELL
G. Storti, J. Culik, and C. Wrigley Jul. 1980 55 p refs Prepared for JPL
(Contract JPL-954883)
(NASA-CR-163522; SX/115/PL-2) Avail: NTIS HC A04/MF A01 CSCL 10A

Alternate processing technologies were developed and introduced into the pilot line with a resulting increase in the efficiency of the thin cells. The introduction of an aluminum paste alloy technique for the formation of a back surface field represents a significant advance over previous techniques. The fabrication and results for quantities in excess of 2000 2 cm x 2 cm thin cells and 1000 5 cm x 5 cm thin cells are described. Substantial improvement in performance and yield of the thin cells were obtained. The overall yield of the 2 cm x 2 cm pilot line was better than 38%, while the best lot yield was greater than 51%. The average power density of the 2 cm x 2 cm cells was approximately 16.8 mW/sq cm with an average AMO (at 25 C) efficiency of 12.4%. The lot yield of the 5 cm x 5 cm pilot line improved from only 7% at the beginning of the operation to better than 17% as experience was gained. The average 5 cm x 5 cm thin cell had an AMO efficiency (at 25 C) of 11.5%. A.R.H.

N80-31877*# Motorola, Inc., Chicago, Ill.
PHOTOVOLTAIC MODULE ELECTRICAL TERMINATION DESIGN REQUIREMENT STUDY Final Report
F. J. Mosna, Jr. and J. Donlinger Jul. 1980 150 p refs Prepared for JPL
(Contract JPL-955367; JPL Proj. 2369)
(JPL-955367-80/1; NASA-CR-163518) Avail: NTIS HC A07/MF A01 CSCL 10A

Pertinent electrical termination attributes were identified and used in the development of selection criteria which included function, environmental durability, utility, manufacturing, code, and cost. Significant aspects of each criteria are discussed, and eight different types of terminations are ranked according to their performance in remote, residential, intermediate, and industrial applications. A.R.H.

N80-31878*# Cooperson Brack Associates, Montchanin, Del.
SOLAR ENERGY SYSTEM DEMONSTRATION PROJECT AT WILMINGTON SWIM SCHOOL, NEW CASTLE, DELAWARE Final Report
Jul. 1980 94 p Sponsored by NASA
(Contract EM-78-F-01-5190)
(NASA-CR-161538) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar energy system located at the Wilmington Swim School, New Castle, Delaware is described. The system was designed for a 40 percent heating and a 30 percent hot water solar contribution serving the heat loads in the following order: space heat - new addition, domestic water - entire facility, and pool heating - entire facility. On a cost basis for 2920 hours of operation, the heat reclaimed would cost $969.66 annually if provided by gas at 3.79 per million Btu's. At 5.5 centers per kwh, heat recovery costs of $481.80 percent a net savings of $487.86 annually. L.F.M.

N80-31879*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE COMPUTER CODES TO READ, PLOT AND TABULATE OPERATIONAL TEST-SITE RECORDED SOLAR DATA
Stephen D. Stewart, Robert S. Sampson, Jr., Richard E. Stonemetz, and Sandra L. Rouse Jul. 1980 89 p Sponsored in part by DOE
(NASA-TM-78293) Avail: NTIS HC A05/MF A01 CSCL 10A

Computer programs used to process data that will be used in the evaluation of collector efficiency and solar system performance are described. The program, TAPFIL, reads data from an IBM 360 tape containing information (insolation, flowrates, temperatures, etc.) from 48 operational solar heating and cooling test sites. Two other programs, CHPLOT and WRTCNL, plot and tabulate the data from the direct access, unformatted TAPFIL file. The methodology of the programs, their inputs, and their outputs are described. M.G.

N80-31880*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. SEASONAL REPORT FOR WORMSER, COLUMBIA, SOUTH CAROLINA Contractor Report, Jun. 1979 - May 1980
Aug. 1980 110 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161546) Avail: NTIS HC A06/MF A01 CSCL 10A

The Wormser Solar Energy System's operational performance from April 1979 through March 1980 was evaluated. The space heating subsystem met 42 percent of the measured space heating load and the hot water subsystem met 23 percent of the measured hot water demand. Net electrical energy savings were 4.36 million Btu's or 1277 kwh. Fossil energy savings will increase considerably if the uncontrolled solar energy input to the building is considered. L.F.M.

N80-31881*# National Aeronautics and Space Administration, Washington, D. C.
COMPOSITE ROTOR BLADES FOR LARGE WIND ENERGY INSTALLATIONS
A. Kussmann, J.P. Molly, and D. Muser Apr. 1980 14 p refs Transl. into ENGLISH from DFVLR-Nachr. (West Germany), Jun. 1979 p 40-44 Original language document was announced as A79-41235 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75822) Avail: NTIS HC A02/MF A01 CSCL 10B

The design of large wind power systems in Germany is reviewed with attention given to elaboration of the total wind energy system, aerodynamic design of the rotor blade, and wind loading effects. Particular consideration is given to the development of composite glass fiber/plastic or carbon fiber/plastic rotor blades for such installations. Author

N80-31882*# Westinghouse Research and Development Center, Pittsburgh, Pa.
CELL MODULE AND FUEL CONDITIONER Quarterly Report, Apr. - Jun. 1980
D. Q. Hoover, Jr. Jul. 1980 75 p
(Contracts DEN3-161; DE-AI 03-79ET-11272)
(NASA-CR-159888; DOE/NASA/0161-4; Rept-80-9E6-MARED-R3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10A

The computer code for the detailed analytical model of the MK-2 stacks is described. An ERC proprietary matrix is incorporated in the stacks. The mechanical behavior of the stack during thermal cycles under compression was determined. A 5 cell stack of the MK-2 design was fabricated and tested. Designs for the next three stacks were selected and component fabrication initiated. A 3 cell stack which verified the use of wet assembly and a new acid fill procedure were fabricated and tested. Components for the 2 kW test facility were received or fabricated and construction of the facility is underway. The definition of fuel and water is used in a study of the fuel conditioning subsystem. Kinetic data on several catalysts, both crushed and pellets, was obtained in the differential reactor. A preliminary definition of the equipment requirements for treating tap and recovered water was developed. S.J.

N80-31883*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR COLT YOSEMITE, YOSEMITE NATIONAL PARK, CALIFORNIA Progress Report, May 1979 - Apr. 1980
Aug. 1980 88 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161539) Avail: NTIS HC A05/MF A01 CSCL 10A

The system's operational performance from May 1979 through April 1980 is described. Solar energy satisfied 23 percent of the total performance load, which was significantly below the design value of 56 percent. A fossil savings of 80.89 million Btu's or 578 gallons of fuel oil is estimated. If uncontrolled losses could have been reduced to an inconsequential level, the system's efficiency would have been improved considerably.
L.F.M.

N80-31884*# Old Dominion Univ., Norfolk, Va. Dept. of Mathematical Sciences.
GALLIUM ARSENIDE (GaAs) SOLAR CELL MODELING STUDIES Final Report, 16 May - 16 Aug. 1980
John H. Heinbockel Sep. 1980 55 p refs
(Grant NAG1-64)
(NASA-CR-163538) Avail: NTIS HC A04/MF A01 CSCL 10A

Various models were constructed which will allow for the variation of system components. Computer studies were then performed using the models constructed in order to study the effects of various system changes. In particular, GaAs and Si flat plate solar power arrays were studied and compared. Series and shunt resistance models were constructed. Models for the chemical kinetics of the annealing process were prepared. For all models constructed, various parametric studies were performed.
T.M.

N80-31885# RAND Corp., Santa Monica, Calif.
A QUANTITATIVE EVALUATION OF CLOSED-CYCLE OCEAN THERMAL ENERGY CONVERSION (OTEC) TECHNOLOGY IN CENTRAL STATION APPLICATIONS
E. C. Gritton, R. Y. Pei, J. Aroesty, M. M. Balaban, C. Gazley, R. W. Hess, and W. H. Krase May 1980 137 p refs
(Contract DE-AC01-79PE-70078)
(R-2595-DOE) Avail: NTIS HC A07/MF A01

An evaluation of a closed cycle Ocean Thermal Energy Conversion (OTEC) system for delivery of electric power to the United States is presented. Performance and costs of complete commercial OTEC systems are analyzed at the system level using inputs from component analyses and thermal resource data in the Gulf of Mexico. Such sites could feed the Gulf Coast from the west coast of Florida to the New Orleans area. By exploiting the temperature difference between warm surface waters and cold water from the depths to operate a thermodynamic cycle to generate electricity, OTEC acts as a heat engine that taps the surface waters of tropical and subtropical oceans as a heat source and the cold water originating in the polar regions as a heat sink. Results of the engineering analysis indicate that the system and platform appear to be within the state-of-the-art.
L.F.M.

N80-31886*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 6.0 AMPERE HOUR NICKLE CADMIUM SPACECRAFT CELLS FOR THE DYNAMIC EXPLORER SATELLITE PROGRAM
J. D. Harkness 9 Apr. 1980 18 p
(NASA Order S-57075-AG)
(NASA-CR-160014; WQEC/C-80-128) Avail: NTIS HC A02/MF A01 CSCL 10C

Evaluation tests of 10 nickel cadmium cells are described. Although pressures were greater than what normally was exhibited by General Electric cells in the past, it is recommended that these cells be placed on life test simulating the predicted Dynamic Explorer flight profiles.
L.F.M.

N80-31887*# Naval Weapons Support Center, Crane, Ind.
INITIAL EVALUATION TESTS OF 20.0 AMPHERE-HOUR SEALED NICKEL-CADMIUM CELLS MANUFACTURED FOR NASA'S STANDARD CELL PROGRAM
J. D. Harkness 9 May 1979 61 p
(NASA Order S-57075-AG)
(NASA-CR-160015; WQEC/C-79-144) Avail: NTIS HC A04/MF A01 CSCL 10C

Evaluation tests of 116 nickel cadmium cells provided by four manufacturers are described. Each manufacturer's group of cells, on the average, indicated an increase in plate stack thickness following the test. No limits or requirements were exceeded by any of the cells manufactured by General Electric. Limits/requirements exceeded during the charge portion of the testing are given.
L.F.M.

N80-31888*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 40.0 AMPERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS FOR THE TRACKING DATA RELAY SATELLITE SYSTEM
J. D. Harkness 21 Dec. 1978 17 p
(NASA Order S-53742-AG)
(NASA-CR-160016; WQEC/C-78-416) Avail: NTIS HC A02/MF A01 CSCL 10C

Five cells provided by NASA's Goddard Space Flight Center were evaluated at room temperature and pressure (25 C plus or minus 2 C) with discharges at the 2 hour rate. Measurements of the cell containers following test, indicated an average increase of .006 inches at the plate thickness. Average end of charge voltages and pressures, and capacity output in ampere hours were determined. Three cells exceeded the voltage requirements of 1.52 volts during both c/10 charges at 20 C. All cells exceeded the voltage requirement of 1.52 volts during the 0 C overcharge test, although their end charges were below 1.50 volts. The pressure requirement of 65 psia was exceeded by both pressure transducer cells during c/10 charges at 25 C and 20 C and also during the 0 C overcharge test. The cells with pressure transducers reached a pressure of 20 psia before reaching the voltage limit of 1.550 volts during the pressure versus capacity test, and exhibited a pressure decay of 2 psia during the last 30 minutes of the 1 hour open circuit stand. Average capacity was 51.3 ampere hours.
A.R.H.

N80-31889*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 50.0 AMPERE HOUR NICKEL CADMIUM SPACECRAFT CELLS FOR THE LANDSAT-D SATELLITE PROGRAM
J. D. Harkness 9 Apr. 1980 20 p
(NASA Order S-57077-AG)
(NASA-CR-160017; WQEC/C-80-104) Avail: NTIS HC A02/MF A01 CSCL 10C

Evaluation tests of eight nickel cadmium cells are described. Although high cell pressures were observed, it is recommended that these cells be placed on a near orbit life test.
L.F.M.

N80-31890*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 2, PART 1: SYSTEM ENGINEERING Final Report
G. M. Hanley Washington Sep. 1980 258 p 7 Vol.
(Contract NAS8-32475)
(NASA-CR-3318; SSD-79-0010-2-1) Avail: NTIS HC A12/MF A01 CSCL 10A

Top level trade studies are presented, including comparison of solid state and klystron concepts, higher concentration on the solar cells, composite and aluminum structure, and several variations to the reference concept. Detailed trade studies are presented in each of the subsystem areas (solar array, power distribution, structures, thermal control, attitude control and stationkeeping, microwave transmission, and ground receiving station). A description of the selected point design is also presented.
Author

N80-31891*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 4: TRANSPORTATION ANALYSIS Final

Report
G. M. Hanley Washington NASA Sep. 1980 270 p refs
(Contract NAS8-32475)
(NASA-CR-3321; SSD-79-0010-4-Vol-4) Avail: NTIS HC A12/MF A01 CSCL 10A

Transportation system elements were synthesized and evaluated on the basis of their potential to satisfy overall satellite (SPS) transportation requirements and of their sensitivities, interfaces, and impact on the SPS. Additional analyses and investigations were conducted to further define transportation system concepts that will be needed for the developmental and operational phases of an SPS program. To accomplish these objectives, transportation systems such as shuttle and its derivatives have been identified; new heavy lift launch vehicle concepts, cargo and personnel orbital transfer vehicles and intra-orbit transfer vehicle concepts have been evaluated. To a limited degree, the program implications of their operations and costs were assessed. The results of these analyses have been integrated into other elements of the overall SPS concept definition studies. T.M.

N80-31892# Avco Systems Div., Wilmington, Mass.
HIGH ENERGY DENSITY COMPOSITE FLYWHEEL PROGRAM Final Report, Jun. 1976 - May 1980
A. D. Sapowith, A. L. Gurson, and J. A. McElman 30 May 1980 155 p refs
(Contract DAAG53-75-C-0269)
(AD-A087076; AVSD-0170-80-RR) Avail: NTIS HC A08/MF A01 CSCL 11/4

A bi-directional composite flywheel was instrumented with strain gages and tested to destruction. The flywheel was designed to exhibit constant stress in both radial and circumferential directions for all radial positions. Strain gage data verified this design. The burst speed was 38,741 rpm representing a specific energy level of 32.3 Wh/lb. The flywheel was constructed of Kevlar composite, had an outside diameter of 19.5 in., an axial thickness of 1.5 in. and weighed 18.6 lbs. Premature failure was initiated at the inside diameter by excessive pressure exerted by a metal hub. A polyacrylate hub design, with test data, is presented to solve this problem. GRA

N80-31893# GTE Labs., Inc., Waltham, Mass.
INVESTIGATION OF METHODS TO ELIMINATE VOLTAGE DELAY IN Li/SOCl2 CELLS Final Report, 19 Sep. 1978 - 19 Sep. 1979
Carl Schlaikjer, Clifton A. Young, and Marc Dobrusin May 1980 61 p refs
(Contract DAAB07-78-C-0558; DA Proj. 1L1-61102-AH-47)
(AD-A086992; DELET-TR-78-0558-1F) Avail: NTIS HC A04/MF A01 CSCL 10/3

A comparative study of thionyl chloride electrolytes containing LiAlCl4, Li2B10Cl10, or Li2B12Cl12 has been carried out by monitoring LiCl film growth on lithium samples stored in these electrolytes and by evaluating the startup and measuring the capacity of anode limited lithium/thionyl chloride cells. The film growth on lithium samples was monitored by galvanostatic pulse polarization, by weight gain analysis, and by examination under the scanning electron microscope. The film growth rate on lithium in Li2B10Cl10/SOCl2 was found to be comparable to that in pure SOCl2, about one tenth of that found in LiAlCl4/SOCl2. Storage for longer periods of time or higher temperatures caused thicker films to form. The polyhedral borate electrolyte produced smooth films on lithium with widely scattered crystals, instead of closely packed crystals as in LiAlCl4/SOCl2. Lithium/thionyl chloride cells containing Li2B10 Cl10/SOCl2 started without delay at -20 C, even after prolonged storage at elevated temperature. The polyhedral borate electrolyte also reduced self discharge by local cell reduction of the solvent against cell hardware connected to the anode. GRA

N80-31894# Technical Univ. of Denmark, Lyngby.
SOLAR ENERGY APPLICATIONS FOR DWELLING; MODELLING AND SIMULATION PART Final Report
Ove Joergensen 1980 109 p
(EUR-6681/I-EN) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

Methods developed within the EC countries are presented and compared. The methods were used to predict the performance of three different solar heating systems: a domestic hot water system, a pure house heating system, and a combined system. Three different sets of weather data were used: Carpentras, Hamburg, and Ireland. The comparisons were undertaken on three different timebases: yearly, monthly, and hourly. A sensitivity analysis was formed on different parameters by different programs. DOE

N80-31895# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A REVIEW OF THE METHODS FOR PASSIVE SOLAR SYSTEMS ANALYSIS M.S. Thesis
Albert P. Allan and Gary D. Transmeir Jun. 1980 140 p refs
(AD-A087509; AFIT-LSSR-66-80) Avail: NTIS HC A07/MF A01 CSCL 10/1

Due to recent needs expressed by the Air Force, a review and evaluation of the methods of analysis for passive solar energy systems was conducted. The methods of analysis evaluated were those that could be worked without the use of computers or programmable calculators. A selection model was designed to systematically and objectively evaluate the methods. The selection model was a variation of a scoring model and based on six criteria. The criteria were: performance, economics, flexibility, implementation, usability, and computing devices. Of the methods evaluated, the Passive Solar Design Handbook was the recommended method of analysis to be used in the Air Force. The method was written by the Los Alamos Scientific Laboratory for the Department of Energy. This method was comprehensive yet simple to use and understand. GRA

N80-31896# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 2, BOOK 1: CONCEPTUAL DESIGN, SECTIONS 1 THROUGH 4 Final Report
Jan. 1980 277 p
(Contract DE-AC03-78ET-20567)
(DOE/ET-20567/1-2-Bk-1; ESG-79-30-Vol-2-Bk-1) Avail: NTIS HC A13/MF A01

Solar/fossil steam Rankine cycle, commercial scale, power plant systems that are economically viable and technically feasible are described. The market analysis, parametric analysis, and the selection process for the preferred system are given. Author (DOE)

N80-31897# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 2, BOOK 2: CONCEPTUAL DESIGN, SECTIONS 5 AND 6 Final Report
Jan. 1980 317 p refs
(Contract DE-AC03-78ET-20567)
(DOE/ET-20567/1-2-Bk-2; ESG-79-30-Vol-2-Bk-2) Avail: NTIS HC A14/MF A01

Solar/fossil steam Rankine cycle, commercial scale, power plant systems that are economically viable and technically feasible are described. The detailed conceptual design and cost/performance estimates and an assessment of the commercial scale solar central receiver hybrid power system are given. Author (DOE)

N80-31898# Midwest Research Inst., Golden, Colo.
BASIC RESEARCH NEEDS AND PRIORITIES IN SOLAR ENERGY. VOLUME 1: EXECUTIVE SUMMARY. TECHNOLOGY CROSSCUTS FOR DOE
T. S. Jayadev, ed. and David Roessner, ed. Jan. 1980 49 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-351-358-Vol-1) Avail: NTIS HC A03/MF A01

Priorities for basic research important to the future development of solar energy are presented. More than 120 leading scientists who were engaged in or knowledgeable of solar related research were surveyed. The scientific disciplines included in the report were chemistry, biology, materials sciences, engineering and mathematics, and the social and behavioral sciences. Each discipline was subdivided into two to five topical areas and,

within each topical area, research needs were described and ranked according to the priorities suggested in the survey. Three categories of priority were established: Crucial, important, and needed. A narrative accompanying the description of research needs in each topical area discusses the importance of research in the area for solar energy development and presents the bases for the priority rankings recommended. DOE

N80-31899# Midwest Research Inst., Golden, Colo.
BASIC RESEARCH NEEDS AND PRIORITIES IN SOLAR ENERGY. VOLUME 2: TECHNOLOGY CROSSCUTS FOR DOE
J. S. Jayadev and D. Roessner Jan. 1980 93 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-351-358-Vol-2) Avail: NTIS HC A05/MF A01

Priorities for basic research important to the future development of solar energy are identified, described, and recommended. The scientific disciplines included in the report are: chemistry; biology; materials sciences; engineering and mathematics; and the social and behavioral sciences. Each discipline is subdivided into two to five topical areas and within each topical area research needs are described and ranked according to the priorities suggested in the survey. Three categories of priority were established: crucial, important, and needed. The importance of research in the area for solar energy development is discussed and the bases for the priority rankings recommended are presented. DOE

N80-31900# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
SITES FOR WIND-POWER INSTALLATIONS: PHYSICAL MODELING OF THE INFLUENCE OF HILLS, RIDGES AND COMPLEX TERRAIN ON WIND SPEED AND TURBULENCE. PART 1: EXECUTIVE SUMMARY
R. N. Meroney, V. A. Sandborn, R. J. B. Bouwmeester, H. C. Chien, and M. Rider Jun. 1978 102 p refs
(Contract EY-77-S-06-2438)
(RLO-2438-78/1) Avail: NTIS HC A06/MF A01

Wind tunnel model measurements were performed to study the influence of topography profile, surface roughness and stratification on the suitability of various combinations of these variables for wind power sites. For the range of examined cases (large turbulence integral scales with respect to surface feature scales) the flow is dominated by inviscid dynamics. Detailed tables of velocity, turbulence intensity, pressure, spectra, etc., were prepared to guide numerical model design and experimental rule of thumb constrictions. Cases include hill slopes, neutral and stratified flows, two and three dimensional symmetric ridges, six alternate hill and escarpment shapes, and a variety of windward versus leeward slope combinations to evaluate ridge separation characteristics. DOE

N80-31901# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
SITES FOR WIND-POWER INSTALLATIONS: WIND CHARACTERISTICS OVER RIDGES, PART 2 Final Report
R. J. B. Bouwmeester, R. N. Meroney, and V. A. Sandborn Jun. 1978 122 p refs
(Contract EY-77-S-06-2438)
(RLO-2438-78/2) Avail: NTIS HC A06/MF A01

A wind tunnel study of the flow field over triangular shaped and sinusoidal shaped ridge models with varying upwind and downwind slopes under various thermal stratification conditions was conducted. A simple technique was developed to predict the velocity amplification profile above a ridge crest for an arbitrary ridge slope. Largest speedups were measured for the steepest symmetrical ridge which did not cause flow separation. Criteria for flow separation over ridges are provided in this report. Applicability of the results for ridges with finite width is discussed. DOE

N80-31902# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Quarterly Progress Report, period ending 31 Dec. 1979
Apr. 1980 336 p
(Contract W-7405-eng-26)
(ORNL-5630) Avail: NTIS HC A15/MF A01

Research and development projects that were carried out in support of the increased utilization of coal are described. Other fossil fuel alternatives to oil and gas as sources of clean energy are described. DOE

N80-31903# Acurex Corp., Mountain View, Calif. Alternate Energy Div.
DESIGN, CONSTRUCTION, AND OPERATION OF A 150 KW SOLAR-POWERED IRRIGATION FACILITY, PHASE 2 Final Report, 30 Sep. 1977 - 30 Sep. 1979
D. Duffy, M. Matteo, and D. Rafinejad May 1980 147 p refs
(Contract EG-77-C-04-4159)
(ALO-4159-1) Avail: NTIS HC A07/MF A01

A solar powered experimental facility providing 150 kW of electric power for the operation of deep well irrigation pumps was designed and constructed. The solar collectors tracked on full automatic, and the power conversion system was started and operated on automatic control. DOE

N80-31904# Rockwell International Corp., Thousand Oaks, Calif.
ADVANCED PHOTOVOLTAIC CONCENTRATOR CELLS Quarterly Technical Progress Report, 1 Dec. 1979 - 29 Feb. 1980
S. W. Zehr, H. T. Yang, J. J. Yang, and J. S. Harris, Jr. 1980 31 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-77CH-00178)
(DSE-4042-T40; QTPR-2) Avail: NTIS HC A03/MF A01

Activities aimed at demonstrating the technical feasibility of advanced high efficiency concentrator solar converters are described. They were largely focused on the development and study of low bandgap cell structures and attempts to develop suitable techniques for the thermal bonding operation. DOE

N80-31905# University of Southern California, Los Angeles. Dept. of Materials Science.
LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Final Technical Report, 1 Sep. 1978 - 31 Aug. 1979
F. A. Kroeger 1979 34 p
(Contract EY-76-S-03-0113-040)
(SAN-0113/40-3) Avail: NTIS HC A03/MF A01

A variety of silicon compounds were chosen for electrolysis experiments. These compounds are dissolved in non aqueous solvents. Where the conductivity of the solutions is low, supporting electrolytes were added. The electrolysis was carried out using silicon nickel, conducting glass, stainless-steel or copper cathodes, graphite, platinum or silicon anodes and saturated calomel or Ag/AgCl as reference electrodes. The silicon coatings obtained by electrolysis vary in color. Energy dispersive X-ray analysis in the scanning electron microscope indicated the coatings to contain large concentrations of silicon; infrared absorption and reflection studied showed bands characteristics of SiO, SiCl or SiF vibrations, and thus indicates the presence of these elements in the films. No Si-H bands were observed. Doping reagents were added to the electrolyte and a-Si coatings doped with phosphorous or boron were obtained. These were tested by hot point probe for the thermoelectric carrier type. The electrical resistance of the coatings was determined by measuring the potential drop when the electrolysis was interrupted as a function of films thickness. DOE

N80-31906# Midwest Research Inst., Golden, Colo.
DEVELOPMENT OF HIGH EFFICIENCY CASCADE SOLAR CELLS Quarterly Technical Progress Report
31 Mar. 1980 16 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T38; QTPR-3) Avail: NTIS HC A02/MF A01

Development of AlGaAsSb/GaAsSb materials, GaInP materials via VPE, GaAlAs/GaAs cell, and OM/CVD studies is reported. Spectral response, V-I characteristics, and electron microprobe analysis results are presented. DOE

N80-31907# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR CELL APPLICATIONS: EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS Quarterly Progress Report, 9 Jul. - 8 Oct. 1979

K. Vedam Nov. 1979 31 p
(Contract DE-AC04-79ET-23013)
(DOE/ET-23013/T4; QPR-2) Avail: NTIS HC A03/MF A01

Numerous cadmium telluride films with excess Cd or Te were prepared by controlled RF sputtering technique and characterized. It was found that slight excess of Cd or Te affects the structure, as well as the electrical resistivity of the film, markedly. Ohmic contacts with fairly low contact resistance were achieved on Cd-rich specimens. DOE

N80-31908# Florida Univ., Gainesville. Coll. of Engineering.
PHYSICAL MODELS OF THIN FILM POLYCRYSTALLINE SOLAR CELLS BASED ON MEASURED GRAIN-BOUNDARY AND ELECTRONIC PARAMETER PROPERTIES Quarterly Report
Fredrik A. Lindholm, J. G. Fossum, P. A. Holloway, and A. Neugroschel Dec. 1979 40 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T37) Avail: NTIS HC A03/MF A01

Models were developed for recombination currents in polysilicon pn-junction solar cells. Several analytic approximations, were used and checked ultimately for self-consistency with the results of the analysis. The models were defined such that their parameters can be related directly to measurements, and the models were hence useful in interpreting experimental results. They also can be used to study, in a systematic way, cell-design modifications to improve the efficiency, e.g., grain-boundary passivation techniques. DOE

N80-31909# Mobil Tyco Solar Energy Corp., Waltham, Mass.
AMORPHOUS SILICON THIN FILM HETEROJUNCTION SOLAR CELLS Annual Report, 24 Sep. 1978 - 30 Nov. 1979
M. C. Cretella, J. A. Gregory, D. B. Sandstrom, and W. P. Paul Mar. 1980 71 p refs
(Contract DE-AC03-78ET-20460)
(DOE/ET-20460/4) Avail: NTIS HC A04/MF A01

A flexible slow discharge apparatus capable of yielding reproducible uniform films of a-Si(H) to provide a reference material for comparison with subsequent alloyed materials was developed. C substituted and Ge substituted a-Si/sub x/M/sub 1-x(H) alloys were prepared over a range of compositions and on a variety of substrate materials. Tin substitution was also attempted. Two types of measurements were made: (1) those to evaluate the material properties and (2) those to determine device characteristics. The techniques included examining the features of the infrared vibrational spectra, the determination of the absorption edge and the optical energy gap, measurements of the dark conductivity and the photo conductivity performance as solar cells and the spectral response of junction devices.
Author (DOE)

N80-31910# Boeing Aerospace Co., Seattle, Wash.
EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS, CU/SUB 2-x/Se Final Report, 1 May 1979 - 30 Apr. 1980
R. A. Mickelsen, J. M. Stewart, and W. S. Chen Apr. 1980 37 p refs
(Contract DE-AC04-79ET-23005)
(DOE/ET-23005/T4) Avail: NTIS HC A03/MF A01

Copper selenide (Cu/sub 2-x/Se) films were investigated as a promising potential semiconductor material for low cost, mass produced thin film photovoltaic solar cells. Major activities were the development of the semiconductor film formation process, characterization of the deposited films, calculation of the projected cell performance from theoretical analysis, and the fabrication and testing of simple cell structures. DOE

N80-31911# Midwest Research Inst., Golden, Colo. Industrial Applications and Policy Branch.
INVESTIGATION OF LEARNING AND EXPERIENCE CURVES
Frank Krawiec, John Thornton, and Michael Edesess Apr. 1980 193 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-353-459) Avail: NTIS HC A09/MF A01

The applicability of learning and experience curves for predicting future costs of solar technologies is assessed, and the major test case is the production economics of heliostats. Alternative methods for estimating cost reductions in systems manufacture are discussed, and procedures for using learning and experience curves to predict costs are outlined. Because adequate production data often do not exist, production histories of analogous products/processes are analyzed and learning and aggregated cost curves for these surrogates estimated. If the surrogate learning curves apply, they can be used to estimate solar technology costs. However, an approach that combines a neoclassical production function with a learning by doing hypothesis is needed to yield a cost relation compatible with the historical learning curve and the traditional cost function of economic theory. DOE

N80-31912# Physical Sciences, Inc., Woburn, Mass.
COAL PROCESSING FOR FUEL CELL UTILIZATION; TASK 9: ONE-DIMENSIONAL (STREAMTUBE) MODEL FOR ENTRAINED-FLOW GASIFIER ANALYSIS
P. F. Lewis and M. L. Finson Oct. 1979 72 p refs
(Contract EW-78-A-21-8450)
(METC-8450-T2-Vol-1; TR-198A) Avail: NTIS HC A04/MF A01

A model was developed to describe the phenomena which occur in entrained flow gasifiers similar to the METC G3 approximation, and includes finite rate pyrolysis and homogeneous and heterogeneous chemistry. The model also includes radiative and conductive heat transfer, and has the capability of including a distribution of particle sizes. The results indicate that finite rate gas phase chemistry and the presence of smaller particles play a significant role in determining the location of the flame within the gasifier. DOE

N80-31913# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYTICAL PREDICTION OF LIQUID PHOTOVOLTAIC/THERMAL FLAT-PLATE COLLECTOR PERFORMANCE
Pattabiraman Raghuraman 29 Nov. 1979 19 p refs
(Contract EY-76-C-02-4094)
(COO-4094-66) Avail: NTIS HC A02/MF A01

A one dimensional analysis that predicts the electrical and thermal efficiencies of a liquid photovoltaic/thermal flat plate collector was developed. The analysis, reduces the 15 percent difference between analysis and measured thermal efficiency obtained by the classical analysis of Hottel and Whillier. DOE

N80-31914# Technische Hogeschool, Delft (Netherlands).
ABSORPTION REFRIGERATION MACHINE DRIVEN BY SOLAR HEAT Final Report
C. Keizer and S. H. Liem 1980 101 p refs
(EUR-6748-EN) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

A mathematical model of a single and a two stage solar absorption regrigeration system is developed in which data of collectors and weather data can be implicated. The influence of the generator, the absorber efficiencies, and the cooling temperature on the coefficient of performance (COP) of a singe and two stage absorption refrigeration process are investigated. For low generator temperatures the absorber efficiency has more influence on COP than the generator efficiency. Only spectral selective double window and high performance collectors can be used for air cooled solar absorption refrigeration systems at an evaporator temperature of -5 C. It is concluded that a water cooled solar absorption refrigeration system in combination with a solar tapwater installation for household use can be achieved with 6 to 8 square meters high performance collector area. DOE

N80-31915# Illinois Univ. at Urbana-Champaign, Urbana. Office of Vice Chancellor for Research.
ENERGY ANALYSIS OF GEOTHERMAL-ELECTRIC SYSTEMS
Robert A. Herendeen and Randall Plant Dec. 1979 215 p refs
(Contract ET-78-S-02-5085)
(COO-5085-4) Avail: NTIS HC A10/MF A01

Standard energy analysis was applied to 4 types of geothermal-electric technologies: liquid dominated, hot dry rock, geopressure, and vapor dominated. It was found that all are net energy producers. Expected uncertainties are not large enough to threaten this conclusion. Vapor dominated, the only technol-

ogy in current commercial use to produce electricity in the US, has the highest energy ratio (13 +- 4). These results for energy ratio are equal to or less than some from other workers. In the case of liquid dominated, environmental control technology has a considerable energy requirement. DOE

N80-31916# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

EFFECT OF CIRCUMSOLAR RADIATION ON PERFORMANCE OF FOCUSING COLLECTORS

Paul Bendt and Ari Rabl Apr. 1980 58 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-34-093) Avail: NTIS HC A04/MF A01

Circumsolar data are used to develop fast computational procedures for calculating the effect of circumsolar radiation on both the instantaneous and the long term average performance of focusing collectors. For predictions of long term average performance, a standard synthetic circumsolar scan has been developed that describes the brightness distribution of the solar disk (limb darkening) and of the circumsolar region. The radiation intercepted by a receiver is calculated separately for the solar portion and for the circumsolar portion of this standard Sun shape, and these two contributions are then weighted according to the long term average circumsolar ratio for the location and period under study. DOE

N80-31917# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

OPTICAL ANALYSIS OF POINT FOCUS PARABOLIC RADIATION CONCENTRATORS

Paul Bendt and Ari Rabl Apr. 1980 39 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-631-336) Avail: NTIS HC A03/MF A01

A simple formalism is developed for analyzing the optical performance of point focus parabolic radiation concentrators. To account for off axis aberrations of the parabola, an angular acceptance function is defined as that fraction of a beam of parallel radiation incident on the aperture which would reach the receiver if the optics were perfect. The radiation intercepted by the receiver of a real concentrator is obtained as a convolution of angular acceptance function, of optical error distribution, and of angular brightness distribution of the radiation source. Losses resulting from absorption in the reflector or reflection at the receiver are treated by a multiplicative factor rho alpha where rho equals reflectance of the reflector and alpha equals absorptance of the receiver. For numerical calculations, this method is more accurate and less time consuming than the ray tracing method. In many cases, there are acceptable approximations whereby the results can be obtained by reading a graph or evaluating a simple curve fit. DOE

N80-31918# Sandia Labs., Albuquerque, N. Mex. Thermal Subsystems Div.

THERMAL ENERGY STORAGE FOR SOLAR THERMAL APPLICATIONS PROGRAM Progress Report, Oct. 1979 - Mar. 1980

Lee G. Radosevich May 1980 100 p ref

(Contract DE-AC04-76DP-00789)

(SAND-80-8218) Avail: NTIS HC A05/MF A01

Developments in thermal energy storage technology are reported including: (1) storage for water/steam cooled collector receiver; (2) storage for molten salt cooled sensible heat collector/receiver; (3) storage for liquid metal cooled sensible heat collector/receiver; (4) storage for gas cooled sensible heat collector receiver; (5) storage for organic or silicone fluid cooled sensible heat collector/receiver; and (6) dish mounted latent heat buffer storage. DOE

N80-31919# Rockwell International Corp., Golden, Colo.

ALUMINUM-SILVER ALLOY FILMS FOR SOLAR REFLECTORS

R. O. Adams, C. W. Nordin, and K. D. Masterson 1980 14 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21 Apr. 1980 Prepared in cooperation with Midwest Research Inst., Golden, Colo.

(Contract DE-AC04-76DP-03533)

(REP-3021; CONF-800439-5) Avail: NTIS HC A02/MF A01

Films of aluminum silver alloys were formed using triode sputtering. Films with a wide variety of composition were produced and evaluated. Films deposited at low substrate temperatures had a high specular reflectance. At higher temperatures two phase alloys formed which had rough low reflecting surfaces. DOE

N80-31920# Boeing Co., Seattle, Wash.

SOLAR PROJECT DESCRIPTION FOR SIR GALAHAD COMPANY, SINGLE FAMILY RESIDENCE, VIRGINIA BEACH, VIRGINIA

20 Jul. 1979 51 p

(Contracts EX-76-A-29-1020; HUD-H-2372)

(SOLAR/1028-79/50) Avail: NTIS HC A04/MF A01

A solar energy system designed to provide solar energy for space heating and domestic hot water heating is described. Solar energy is collected by an array of double glazed flat plate collectors with a gross area of 640 square feet. Solar energy is transferred from the collector array to a 1500 gallon above ground storage tank. Water is used as the heat collection, transfer and storage medium. Freeze protection is provided by means of circulation of hot water from storage through the collectors. Space heating demands are met by circulating hot water from storage through air heating coils in an air distribution system located in the house. Auxiliary space heating is provided by a heat pump and electric heater strips. Solar energy for preheating domestic hot water is provided by circulating water from the solar storage tank through a water to water heat exchanger located solar storage tank. The dwelling has been fully instrumented for performance evaluation since October 1978. Original cost estimates for provisioning and installation of the solar system are given. DOE

N80-31921# Honeywell, Inc., Minneapolis, Minn. Technology Strategy Center.

DUAL CURVATURE ACOUSTICALLY DAMPED CONCENTRATING COLLECTOR Final Technical Report

G. A. Smith and R. A. Rausch May 1980 348 p refs

(Contracts EM-78-C-04-4196; DE-AC04-78CS-34196)

(DOE/CS-34196/T1) Avail: NTIS HC A15/MF A01

The design and performance parameters of a dual curvature, concentrating solar collector are investigated. The reflector of the solar collector is achieved with a stretched film reflective surface that approximates a hyperbolic paraboloid and is capable of line focusing at concentration ratios ranging from 10 to 20X. A prototype collector was designed based on analytical and experimental component trade off activities as well as economic analyses of solar thermal heating and cooling systems incorporating this type of collector. A prototype collector incorporating six 0.66 x 1.22 m (2 x 4 ft) was fabricated and subjected to a limited thermal efficiency test program. A peak efficiency of 36% at 121 C (250 F) was achieved based upon the gross aperture area. Commercialization activities were conducted, including estimated production costs of $134.44/sq m for the collector assembly (including a local suntracker and controls) and $24.33/sq m for the reflector subassembly. DOE

N80-31922# Gilbert/Commonwealth, Reading, Pa.

FEASIBILITY STUDY: FUEL CELL COGENERATION IN A WATER POLLUTION CONTROL FACILITY, VOLUME 1 Final Report

J. H. Hirschenhofer, D. B. Baillieul, L. M. Barton, R. J. Brumberg, C. E. Hannan, H. H. Fiedler, M. G. Kile, M. G. Klett, G. A. Malone, H. P. Milliron et al Feb. 1980 151 p refs Prepared in cooperation with the Bergen County Utilities Authority, Little Ferry, N.J.; Public Service Electric and Gas Co., Newark, N.J.; and United Technologies Corp., East Hartford, Conn.

(Contract DE-AC03-78ET-12431)

(DOE/ET-12431/T1-Vol-1) Avail: NTIS HC A08/MF A01

A conceptual design study was conducted to investigate the technical and economic feasibility of a cogeneration fuel cell power plant operating in a large water pollution control facility. In this particular application, the fuel cell power plant would use methane rich digester gas from the water pollution control facility as a fuel feedstock to provide electrical and thermal energy. Several design configurations were evaluated. These configurations were comprised of combinations of options for locating the fuel cell power plant at the site, electrically connecting it with the water pollution control facility, using the rejected

power plant heat, supplying fuel to the power plant, and for ownership and operation. A configuration was selected which met institutional/regulatory constraints and provided a net cost savings to the industry and the electric utility. DOE

N80-31923# California Univ., Berkeley. Lawrence Berkeley Lab. *Information Methodology Research Project.*

MATERIAL-FLOW DATA STRUCTURES AS A BASIS FOR ENERGY INFORMATION SYSTEM DESIGN

V. V. Krishnan and D. F. Cahn Apr. 1980 20 p refs Presented at 9th Mid-Yr. Meeting of the Am. Soc. for Inform. Sci., Pittsburgh, 15-17 May 1980

(Contract W-7405-eng-48)

(LBL-10248; CONF-800529-3) Avail: NTIS HC A02/MF A01

The US petroleum supply and distribution system is analyzed. Data structures conducive to information system design are developed. Quantized petroleum flows among restricted channels in the distribution net form the basis of the data structure. The resultant vectorial representations provide a direct link between conceptual models of system function and information system implementations. Simultaneously, they ease otherwise difficult problems such as data validation and error isolation. DOE

N80-31924# Sandia Labs., Albuquerque, N. Mex. Midtemperature Solar Subsystems Test Facility.

FIELD EXPERIENCE WITH SOLAR CONCENTRATING COLLECTOR CONTROL SYSTEMS

H. J. Gerwin 1980 4 p ref Presented at Joint Autom. Control Conf., San Francisco, 13 Aug. 1980

(Contract DE-AC04-76DP-00789)

(SAND-79-2044C; CONF-800805-6) Avail: NTIS HC A02/MF A01

Various types of solar concentrating collectors were tested and evaluated. Each collector type has a different control system that includes a Sun tracker sensor, fluid flow control, and safety circuits for equipment protection. The Sun tracker system sensors that were tested include shadow band, linear concentrated flux, computer driven (ephemeris), optical balance, and linear flux integration. Most of the systems evaluated were early development models and comparisons are made on the basis of field test conditions. Several fluid flow control approaches were included with the collectors. Generally, the fluid controls were designed to maintain a constant temperature by either varying the pump speed or a control valve. The safety circuits were designed to operate on signals such as overtemperature, insufficient fluid flow, and overtravel. Component failures and corrective actions are also discussed. DOE

N80-31925# Sandia Labs., Albuquerque, N. Mex. Systems Analysis.

SCRAM: A FAST COMPUTATIONAL MODEL FOR THE OPTICAL PERFORMANCE OF POINT FOCUS SOLAR CENTRAL RECEIVER SYSTEMS

Kenneth D. Bergeron and Clement J. Chiang Apr. 1980 41 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-0433; TID-4500-R67-UC62) Avail: NTIS HC A03/MF A01

A mathematical approximation procedure, designated Sandia Central Receiver Approximation Model is described. A computational procedure which allows the user to define the heliostat field boundaries and tower height arbitrarily, generating a model for optical field performance, including shadowing, blocking, cosine, losses, and atmospheric attenuation, and which requires only a polynomial evaluation for each set of Sun angles was developed. One reason that the accuracy in field performance predictions is higher than that of the generating function for the model is that much of the error in the generating function is due to an oscillatory behavior associated with a moire pattern in the optical response of the heliostat field. DOE

N80-31926# Midwest Research Inst., Golden, Colo.

ANALYTICAL MODELING OF LINE FOCUS SOLAR COLLECTORS

John D. Wright Apr. 1980 8 p refs Presented at the Joint Autom. Control Conf., San Francisco, 13 Aug. 1980

(Contract EG-77-C-01-4042)

(SERI/TP-333-591; CONF-800805-1) Avail: NTIS HC A02/MF A01

Simplified models relating deviations in outlet temperature to changes in inlet temperature, insolation, and fluid flow rate are illustrated. The basic responses and the distributed parameter nature of line focus collectors are described. Detailed models were used to develop transfer functions and frequency response curves useful for design. DOE

N80-31927# California Univ., Berkeley. Sanitary Engineering Research Lab.

SOLAR ENERGY CONVERSION THROUGH BIOPHOTOLYSIS Annual Report, 1 Apr. 1978 - 31 Mar. 1979

J. R. Benemann, M. A. Murray, P. C. Hallenbeck, K. Miyamoto, A. G. Olafsen, D. J. Esteva, and L. V. Kochian 1 May 1979 236 p refs

(Contract EY-76-S-03-0034)

(SAN-0034-239-1-T2; AR-3) Avail: NTIS HC A11/MF A01

The state-of-the-art of biophotolysis was reviewed and a bioengineering analysis carried out. The conclusions were that practical biophotolysis systems are feasible; however, they will require, in most cases, relatively long-term research and development. The biophotolysis system developed, utilizing heterocystous blue-green algae, was demonstrated both indoors and outdoors with a model converter system using the heterocystous blue-green alga Anabaena cylindrica. Maximal light energy conversion efficiencies were 2.5 percent indoors and about 0.2 percent outdoors, averaged for periods of about two weeks. Achievement of such rates required optimization of N2 supply and culture density. A small amount of N2 in the argon gas phase used to sparge the cultures was beneficial to the stability of a long-term hydrogen-production activity. A relatively small amount of the hydrogen produced by these cultures can be ascribed to the activity of the reversible hydrogenase which was studied by nitrogenase inactivation through poisoning with tungstate. DOE

N80-31928# Brookhaven National Lab., Upton, N. Y.

ELECTROLYSIS-BASED HYDROGEN STORAGE TECHNOLOGY

Gerald Strickland Nov. 1979 6 p Presented at the ANS Meeting, San Francisco, 12 Nov. 1979

(Contract DE-AC02-76CH-00016)

(BNL-26923; CONF-791103-112) Avail: NTIS HC A02/MF A01

The major development areas deal with advanced water electrolysis systems, hydrogen storage materials and systems, and end-use applications. Work on hydrogen production deals with improving the system for KOH electrolysis, and on developing the acidic solid-polymer-electrolyte system for the electrolysis of water. The advantages of the techniques for storing hydrogen via metal hydrides and hollow glass microspheres are described. TiFe-based hydride was tested as an energy storage medium for electric energy storage, for automotive fuel, and for bulk hydrogen storage. Pairs of selected hydrides were used in tests simulating a solar-driven heat pump. The pressure-temperature characteristics of hydrides are being utilized in development of a hydrogen chemical compressor. Glass microspheres are being studied for the automotive fuel application. DOE

N80-31929# General Accounting Office, Washington, D. C.

FEDERAL DEMONSTRATIONS OF SOLAR HEATING AND COOLING ON COMMERCIAL BUILDINGS HAVE NOT BEEN VERY EFFECTIVE

15 Apr. 1980 46 p

(EMD-80-41) Avail: NTIS HC A03/MF A01

An analysis is provided of the commercial buildings solar heating and cooling demonstration program implemented by DOE. A discussion of the objectives of the law authorizing the program and an evaluation of the success of the program in meeting those objectives are included. Practicality, data dissemination, and development of a viable solar industry are discussed. DOE

N80-31930# FWG Associates, Inc., Tullahoma, Tenn.

SUMMARY OF GUIDELINES FOR SITING WIND TURBINE GENERATORS RELATIVE TO SMALL-SCALE, TWO-DIMENSIONAL TERRAIN FEATURES Final Report

Walter Frost and Dieter K. Nowal Mar. 1979 395 p refs

(Contracts DE-AC06-77ET-20242; EY-76-C-06-2443)
(RLO-2443-77/1) Avail: NTIS HC A17/MF A01

The terrain features considered are one or more surface roughness changes on otherwise flat terrain, shelterbelts or windbreaks, and bluff and smooth contoured hills. Estimates are given of the preferred wind turbine generators (WTG) location relative to these terrain features and of the resulting degradation in available wind power due to locating the WTG other than at the preferred site. The siting criteria are based on fluid mechanics analyses of somewhat idealized terrain geometries and prevailing atmospheric conditions. Therefore, the results presented show trends and order of magnitude effects rather than absolute values. The theoretical approach to analyzing the flow field and the reliability of the analytical assumptions for each terrain feature considered are discussed in their respective sections. DOE

N80-31931# Environmental Research Inst. of Michigan, Ann Arbor.
DEMONSTRATION OF AN ADVANCED SOLAR GARDEN WITH A WATER CEILING Technical Progress Report, Jul. - 31 Dec. 1979
Reed Maes, Catherine Riseng, and G. Thomas Feb. 1980 27 p
(Contract DE-FG02-79RS-10122)
(DOE/RS-10122/1) Avail: NTIS HC A03/MF A01

The rationale of the transparent water ceiling is developed and its implementation in the solar garden is described. The experimental procedures for evaluating the water ceiling as an integral part of an ongoing garden agricultural experiment are discussed. DOE

N80-31932# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EVALUATION OF CONTROL STRATEGIES FOR SOLAR COLLECTOR LOOPS
Mashun L. Warren, Steven R. Schiller, and Michael Wahlig Jun. 1980 15 p refs Presented at the Am. Sec. of the ISES Conf., Phoenix, Ariz., 2-6 Jun. 1980
(Contract W-7405-eng-48)
(LBL-10716; CONF-800604-22) Avail: NTIS HC A02/MF A01

Proportional and on/off controllers were evaluated and compared using a theoretical dynamic collector model. Control strategies using various flow rates, controller set points, insolation patterns, ambient temperature conditions, and collector types are evaluated. Energy collection efficiency, parasitic power consumption, pump cycling, and auxiliary heat usage are compared. DOE

N80-31933# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SOLAR ASSISTED HEAT PUMP STUDIES: HEAT PUMP HARDWARE AND EXPERIMENTS, SIMULATIONS, EARTH COUPLING CONTRACTS AND SUPPORTING CONTRACTS
Edward A. Kush 1980 6 p refs Presented at the Ann. DOE Active Solar Heating and Cooling Contractors Rev. Meeting, Incline, Nev., 26-28 Mar. 1980 Sponsored in Part by DOE
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-27668) Avail: NTIS HC A02/MF A01

The status of the heat pump hardware development contracts, the results to date of the in house heat pumps experiments, the progress of the contractural effort in Earth coupling, and the activities of various supporting contracts are summarized. DOE

N80-31934# Minnesota Mining and Mfg. Co., St. Paul. Industrial Electrical Products Div.
THERMOELECTRIC MATERIALS EVALUATION PROGRAM Technical Summary Report
J. D. Hinderman Apr. 1979 288 p refs
(Contract EY-76-C-02-2331)
(MMM-2331-0602) Avail: NTIS HC A13/MF A01

Topical reports are presented on: (1) hot and cold end delta T's, (2) hardware mobility, (3) p-leg sublimation suppression, (4) thermodynamic stability of p-legs, (5) n-leg material process improvements to reduce extraneous resistance, (6) n-leg cracking, (7) dynamic evaluation of converter, and (8) data base and degradation modes. Twenty attachments are included which present supporting drawings, specifications, procedures, and data. DOE

N80-31935# Institute of Gas Technology, Chicago, Ill.
FUEL CELL RESEARCH ON SECOND-GENERATION MOLTEN-CARBONATE SYSTEMS Technical Report, 1 Jul. - 30 Sep. 1979
Dec. 1979 116 p refs
(Contract DE-AC03-78ET-11276; Proj. 61021)
(SAN-11276-2) Avail: NTIS HC A06/MF A01

The development and testing of fuel cell components is discussed. Structural analysis of the cell package showed that electrolyte tile cracking caused by thermal cycling can be greatly reduced by reducing the thermal expansion difference between the cell separator plate and the electrolyte tile and by reducing the ratio of the separator plate thickness to the electrolyte tile thickness. Mechanical property measuremens were made on a variety of electrolyte tile compositions. The tile microstructure (agglomerate size and LiAlO2 distribution) strongly affected the tile strength. Carbonate compositions were identified that matched more closely the thermal expansion of the metallic cell components. Cell testing of these compositions showed good performance. A potentially cost effective method of fabricating electrolyte tiles and electrodes using the tape-casting method was demonstrated. In addition, good powder quality was achieved using the spray-drying technique for electrolyte powder preparation. DOE

N80-31936# Aerodyne Research, Inc., Bedford, Mass.
CHARACTERIZATION OF OPEN-CYCLE, COAL-FIRED MHD GENERATORS Quarterly Technical Progress Report, 1 Jul. 1978 - 30 Apr. 1979
C. E. Kolb, J. Wormhoudt, V. Yousefian, W. Cheng, F. Bien, M. Martinez-Sanchez, and J. Silver May 1979 100 p refs
(Contract EX-76-C-01-2478)
(ARI-RP-43; QTPR-9; QTPR-10) Avail: NTIS HC A05/MF A01

The successful design of full scale open cycle, coal fired MHD generators for baseload electrical production requires a detailed understanding of the plasma chemical and plasma dynamic characteristics of anticipated combustor and channel fluids. Progress in efforts to model negative ion formation and slag condensation effects on core flow conductivity, to improve the ability to sample and characterize laboratory produced coal combustion plasmas, and to measure mechanisms and rates of slag oxide condensation are discussed. A set of parametric calculations showing the influence of various input parameters on a nominal full scale, supersonic generator system is also presented. DOE

N80-31937# United Technologies Corp., South Windsor, Conn. Power Systems Div.
AC/DC POWER CONVERTER FOR BATTERIES AND FUEL CELLS Annual Report
R. W. Rosati, J. L. Peterson, and J. R. Vivirito Dec. 1979 211 p refs
(EPRI Proj. 841-1)
(EPRI-EM-1286) Avail: NTIS HC A10/MF A01

The leading commutating circuit options for an advanced self-commutated-type power converter were tested and analyzed by computer simulation. An analytical and experimental evaluation of advanced commutation circuits, and evaluation of alternative advanced bridge design, selection of the most desirable conceptual design, and the development of a mathematical models converter response are described. Experimental data and preliminary converter specifications are contained in the appendixes. DOE

N80-31938# United Technologies Corp., South Windsor, Conn. Power Systems Div.
DEVELOPMENT OF MOLTEN CARBONATE FUEL CELL POWER PLANT TECHNOLOGY Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
H. C. Healy, R. A. Sanderson, R. J. Wertheim, P. F. Farris, A. P. Mientek, R. C. Nickols, M. Katz, R. P. Iczkowski, R. R. Fredley, R. C. Stewart et al Mar. 1980 80 p
(Contract DE-AC01-79ET-15440)
(DOE/ET-15440/1; QTPR-1) Avail: NTIS HC A05/MF A01

A study baseline fuel cell system and module configuration

were established. Studies to determine user requirements and to characterize the fuel cell power block and coal gasifier subsystems were initiated. Cell stack design was initiated with completion of preliminary design requirements for the cell cathodes. Laboratory tests were also initiated to identify alternative materials for separator plates, reactant manifold seals, and electrolyte tile fillers. A mechanical tape casting technique for producing 18 x 24 inch sheets of electrolyte matrix tape was successfully demonstrated. Theoretical and experimental studies were initiated to define the effects of known sulfur contaminants on cell performance. A literature survey was initiated to identify other possible contaminants. Planning and design efforts for construction of a mobile cell test unit were initiated. The mobile unit will be used to verify the molten carbonate cell's ability to operate on gasified coal by tests at a gasifier site. DOE

N80-31939# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.

ASSESSMENT OF INDUSTRIAL ENERGY CONSERVATION BY UNIT PROCESSES

Doan L. Phung, Willem vanGool, David A. Boyd, Dominique Casavant, Warren D. Devine, Jr., Heriberto Plasa, and William G. Pollard Mar. 1980 191 p

(Contract DE-AC05-76OR-00033)

(ORAU/IEA-80-4-M) Avail: NTIS HC A09/MF A01

The investment required to produce a given amount of conservation, the amount of conservation to be accomplished before costs equal those of new supply, and how a given investment should be allocated to yield the largest energy savings are questions addressed from the perspective of energy use in industrial unit operations. It was found that: a real energy minimum exists which is distinct from the process thermodynamic limit and this minimum represents the limit to conservation; cost/energy relationships for an industrial process can be described to first approximation by a single technology parameter which is characteristic of that particular technology; the technology parameter permits competing technologies to be ranked by energy saving potential for a given investment; and government investment in conservation can be allocated for greatest return using the technology parameters of, and the fractions of energy use by, each of the unit operations. Energy embodied in conservation equipment may, under certain circumstances, decrease the rate at which the benefits of conservation appear in national energy accounts. DOE

N80-31940# Battelle Columbus Labs., Ohio.

PILOT STUDY TO SELECT CANDIDATES FOR ENERGY CONSERVATION RESEARCH FOR THE CHEMICAL INDUSTRY Final Report

J. E. Burch, J. L. Otis, and R. W. Hale 15 Nov. 1979 116 p refs

(Contract W-7405-eng-92)

(DOE/TIC-11114) Avail: NTIS HC A06/MF A01

The functions and energy consumption of the various unit operations involved in several chemical processes are studied and areas where research could lead to energy-conservation options of broad utility to the chemical industry are identified. Four energy-intensive chemical processes which produce ammonia and carbon dioxide, chlorine and caustic soda, carbon black, and ethylbenzene and styrene were selected. Information was obtained from the literature on the structure of the industry sectors and the production technologies, and was used to determine material balances, process streams, temperatures, pressures, and energy requirements for the various unit operations. An energy matrix was prepared for each process, showing the function provided by and the energy involved in each unit operation or process. A variety of chemical engineers and chemists analyzed the energy matrices, flow charts, and other information for each process and made suggestions as to areas wherein research might be expected to produce energy saving results. DOE

N80-31941# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

RESIDENTIAL SOLAR HEATING AND COOLING USING EVACUATED TUBE SOLAR COLLECTORS: CSU SOLAR HOUSE 3, EXECUTIVE SUMMARY Final Report, 1 Feb. 1976 - 30 Sep. 1978

Dan S. Ward, John C. Ward, and H. S. Oberoi Mar. 1979 50 p refs

(Contract EY-76-C-02-2858)

(COO-2858-24) Avail: NTIS HC A03/MF A01

A residential solar heating and cooling system installed in Colorado State University (CSU) Solar House 3 is described. From 1 February 1976 through 31 May 1978 the CSU Solar House 3 system utilized the Owens-Illinois liquid heating evacuated tube solar collector. During the period 1 June 1978 through 30 September 1978, the Chamberlain liquid heating, state-of-the-art plate solar collector was evaluated for a complete cooling season. DOE

N80-31942# Arizona State Univ., Tempe. School of Engineering.

TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION

C. E. Backus and B. D. Wood Mar. 1980 191 p refs

(Contract EY-76-C-04-0789)

(SAND-80-7008) Avail: NTIS HC A09/MF A01

Experiments were conducted on the flux uniformity and spectral distribution in the concentrated sunlight under a 1.08 meter. The preliminary data from these experiments show that the short circuit currents from a cell are directly proportional to the total illumination falling on the surface of the cell and not on the uniformity of the light profile. An available gallium aluminum arsenide cell was used with a hot mirror and a silicon cell to demonstrate that the efficiency of the combined system is greater than that achievable with the use of a single cell. An algorithm for calculating the electrical and thermal performance of a linear concentrated cell array developed. This computer program, based on quasi-steady state analysis, will calculate the array temperature and electrical outputs based on the day, time, transfer fluid inlet temperature and flow rate, ambient temperature, wind speed and direction, optical characteristics of the linear concentrator and solar irradiation. DOE

N80-31943# Aerospace Corp., El Segundo, Calif. Energy and Resources Div.

EVALUATION OF LINE FOCUS SOLAR CENTRAL POWER SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY

15 Mar. 1980 28 p refs

(Contract EY-76-C-03-1101)

(ATR-80(7773-03)-1-Vol-1) Avail: NTIS HC A03/MF A01

An evaluation was completed to ascertain the applicability of line focus technologies to electrical power applications and to compare their performance and cost potential with point focus central receiver power systems. Although the high temperature line focus and fixed mirror line focus concepts duplicate the heat source characteristics and power conversion technology of the central receiver concepts, these configurations do not offer a sufficient improvement in cost to warrant full scale development. The systems are less complex than their point focus counterpart and should the central receiver system development falter they provide reasonable technology alternatives. DOE

N80-31944# Aerospace Corp., El Segundo, Calif. Energy Resources Div.

EVALUATION OF LINE FOCUS SOLAR CENTRAL POWER SYSTEMS. VOLUME 2: SYSTEMS EVALUATION

15 Mar. 1980 213 p refs

(Contract EY-76-C-03-1101)

(ATR-80(7773-03)-1-Vol-2) Avail: NTIS HC A10/MF A01

An evaluation was completed to ascertain the applicability of line focus technologies to electrical power applications and to compare their performance and cost potential with point focus central receiver power systems. It was concluded that although the high temperature line focus and fixed mirror line focus concepts duplicate the heat source characteristics and power conversion technology of the central receiver concepts, these configurations do not offer a sufficient improvement in cost to warrent full scale development. The systems are, however, less complex than their point focus counterpart and should the central receiver system development falter they provide reasonable technology alternatives. The parabolic trough concept was found to provide a low temperature technology alternative to the central receiver concept with promising performance and cost potential. DOE

N80-31945# Massachusetts Univ., Amherst.
CONTINUED EVALUATION OF COMPACT HEAT EXCHANGERS FOR OTEC EVALUATION Final Report
J. G. McGowan DOE Oct. 1979 141 p refs
(Contract EG-77-S-02-4238)
(COO-4238-14) Avail: NTIS HC A07/MF A01

Investigations were carried out to establish the applicability of compact plate type heat exchangers to OTEC power systems and to (1) provide experimental verification of predicted performance (heat transfer and fluid flow) under OTEC operating conditions (using NH2); (2) provide initial performance data for several desirable plate type OTEC heat exchanger panels; (3) provide test apparatus for continued experimental testing of OTEC compact heat exchanger panels; and (4) provide design information on applicable manufacturing processes maintenance requirements and arrangement concepts for plate type heat exchangers. DOE

N80-31946# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Solar Energy.
OCEAN ENERGY SYSTEMS: MULTIYEAR PROGRAM PLAN
May 1980 130 p
(DOE/CS-0161) Avail: NTIS HC A07/MF A01

Specific planned activities to be conducted by the Department of Energy in connection with the Ocean Energy System Program for FY 1979 through FY 1984 are described. Program funding is presently 95 percent OTEC, with 5 percent directed toward alternate energy sources such as salinity gradients waves and currents, technical status, ocean energy systems resource requirements, issues, and a management plan are discussed. DOE

N80-31947# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EFFICIENCY OF ENERGY CONVERSION IN NITINOL
Richard D. Kopa Sep. 1979 77 p refs Presented at the Nitinol Heat Engine Conf., Silver Spring, Md., 26 Sep. 1978
(Contract W-7405-eng-48)
(LBL-9750; CONF-7809211-1) Avail: NTIS HC A05/MF A01

The efficiency of the energy conversion in Nitinol was investigated experimentally. An electronically controlled Cycle Simulator subjected a single Nitinol wire element to the stress strain temperature cycles corresponding to a specific thermodynamic cycle. The test parameters, which were varied singly or in combination, included various stress levels, stress rates, percent of elongation of the wire, temperature levels, heating and cooling rates, cycling speeds, etc. Efficiency values as a function of these variables were plotted in graphs and the factors affecting efficiency are discussed. The fundamental limitation of the energy conversion efficiency is set by the inefficient type of thermodynamic cycle - namely, the isothermal cycle - to which the solid state heat engine operation is restricted. DOE

N80-31948# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jan. 1980 48 p refs
(Contract DE-AC03-78ET-20567)
(DOE/ET/20567-1/1; ESG-79-30-Vol-1) Avail: NTIS HC A03/MF A01

Solar/fossil steam Rankine cycle, commercial scale, power plant systems are presented. Economical viability and technical feasibility of the systems is considered. DOE

N80-31949# Aerospace Corp., El Segundo, Calif. Energy and Resources Div.
RESIDENTIAL PHOTOVOLTAIC SYSTEMS: A REVIEW AND COMPARATIVE EVALUATION OF FOUR INDEPENDENT STUDIES OF POTENTIAL CONCEPTS
Fred C. Finlayson Apr. 1980 75 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-7010) Avail: NTIS HC A04/MF A01

Four independent studies of residential applications of photovoltaic generating systems were recently conducted by major industrial contractors: General Electric, Westinghouse, MIT-Lincoln Labs, and The Aerospace Corporation. The conclusions of the contractors had a number of important similarities and differences. An analysis of the several contractor's results, together with an identification of the sources of their similarities and differences is presented. DOE

N80-31950# Battelle Columbus Labs., Ohio.
PHOTOVOLTAIC INSTITUTIONAL ISSUES STUDY
George A. Watkins, Gerry Noel, John Hagely, John Broehl, Mary Duchi, Harry Small, Tom Martineau, and Ben Maiden Apr. 1980 223 p refs
(Contracts DE-AC04-76DP-00789; W-7405-eng-92)
(SAND-79-7054) Avail: NTIS HC A10/MF A01

Institutional issues are presented in the context of nine prototypical systems, designed to reflect institutional issue variation. Key institutional issues associated with each of the aforementioned issue areas were explored to demonstrate their relevance to application of photovoltaics. Programmatic recommendations are made which could serve to address institutional issues identified. Opportunities for those persons, agencies and governmental entities involved in the commercialization and widespread use of photovoltaics to address the institutional issues identified are included. DOE

N80-31951*# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
METHODOLOGY FOR THE COMPARATIVE ASSESSMENT OF THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE TECHNOLOGIES
T. Wolsko, W. Buehring, R. Cirillo, J. Gasper, L. Habegger, K. Hub, D. Newsom, M. Samsa, E. Stenehjem, and R. Whitfield Jan. 1980 79 p refs Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-163049; DOE/ER-0051) Avail: NTIS HC A05/MF A01

The energy systems concerned are the satellite power system, several coal technologies, geothermal energy, fission, fusion, terrestrial solar systems, and ocean thermal energy conversion. Guidelines are suggested for the characterization of these systems, side-by-side analysis, alternative futures analysis, and integration and aggregation of data. A description of the methods for assessing the technical, economic, environmental, societal, and institutional issues surrounding the development of the selected energy technologies is presented. DOE

N80-31952# Ames Lab., Iowa.
PHOTOELECTROCHEMICAL SOLAR CELLS BASED ON D-BAND ELECTROCHEMISTRY AT TRANSITION METAL DISELENIDES Technical Progress Report, 14 Aug. - 30 Nov. 1979
Thomas E. Furtak and Bruce A. Parkinson Feb. 1980 20 p refs
(Contracts W-7405-eng-82; EG-77-C-01-4042)
(IS-4724) Avail: NTIS HC A02/MF A01

Successful growth of WSe2 crystals led to the production of photocells which operate with greater than 5 percent monochromatic power conversion efficiency in I(-)/I2 solution. Scanning light spot maps were used to identify and evaluate inhomogeneities across the surface and to serve as a reference for the edge passivation program which helped improve performance significantly. Results are discussed. DOE

N80-31953# University of Southern California, Los Angeles. Dept. of Materials Science.
LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Final Technical Report, 1 Sep. 1978 - 31 Aug. 1979
F. A. Kroeger 1979 34 p
(Contract EY-76-S-03-0113)
(SAN-0113-040-T6) Avail: NTIS HC A03/MF A01

A variety of silicon compounds were chosen for electrolysis experiments viz, silicon tetrachloride, silicon tetrabromide, tetraethylorthosilicate, potassium hexafluoro silicate and ammonium hexafluoro silicate. These compounds are dissolved in non aqueous solvents, acetone, acetic acid, ethylene glycol, propylene glycol, propylene carbonate, pyridine, ethylene diamine,

1-chloropropane, formamide, N-Ndi methyl formamide, etc. Where the conductivity of the solutions is low, supporting electrolytes like tetrabutyl ammonium chloride, bromide or perchlorate are added. The electrolysis was carried out using, silicon nickel, conducting, glass, stainless-steel or copper cathodes, graphite, platinum or silicon anodes and saturated calomel or Ag/AgCl as reference electrodes. DOE

N80-31954# Sandia Labs., Albuquerque, N. Mex. Solar Energy Systems Analysis

ANALYTICAL EVALUATION OF A SOLAR THERMOPHOTOVOLTAIC CONVERTER

Michael W. Edenburn May 1980 30 p refs

(Contract DE-AC04-76DP-00789)

(SAND-78-1962) Avail: NTIS HC A03/MF A01

A solar thermophotovoltaic (TPV) converter uses concentrated sunlight to heat a cavity-enclosed emitter to a few thousand degrees kelvin. The emitter illuminates photovoltaic cells with thermal radiation, and the cells convert the radiation into electricity. Emitter temperature, cell reflectance to radiation with energy below the cell's bandgap energy, and concentration ratio requirements are parametrically considered. Concentration ratio is treated in a rigorous manner to determine what concentration values can be practically achieved and what influence they have on converter performance. Important conclusions reached are that an emitter temperature of 2000 K is close to optimum and a cell reflectance value of 0.98 is required for below bandgap radiation. A secondary concentrator must be used and a primary mirror quality resulting in a 4 milliradian reflected-beam dispersion must be obtained to achieve a 24% conversion efficiency. DOE

N80-31955# South Dakota Univ., Vermillion.

PASSIVE SOLAR HEATING OF BUILDINGS WITH ATTACHED GREENHOUSE Progress Report, 29 Feb. - 29 Apr. 1980

Robert W. Jones Apr. 1980 28 p

(Contract DE-AC02-79CS-30242)

(DOE/CS-30242/2) Avail: NTIS HC A03/MF A01

The thermal performance of attached greenhouse buildings analyzed in order to determine the component sizes and configurations which optimize performance. The analytical method is dynamic computer simulation using a thermal network model and actual hourly meteorological and solar radiation data from the northcentral region. Conclusions on design guidelines are discussed. DOE

N80-31956# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div.

LONG-TERM LITHIUM BATTERY TESTS, 2 Semiannual Report

Samuel C. Levy Mar. 1980 16 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-1383; SAR-2) Avail: NTIS HC A02/MF A01

Data from the second 6 month period of a 6 year test of ambient temperature lithium batteries are reported. Lithium-sulfur dioxide cells from three manufacturers and lithium-polycarbon monofluoride cells from a fourth are included. One year's storage at room temperature or below had a minor effect on capacity. Storage at 49 C resulted in a significant capacity loss. Two mechanisms were identified that may result in premature failure of cells stored at elevated temperatures: corrosion of an aluminum-to-tantalum weld in the positive terminal, and an attack on the glass-to-metal seal in the header. Continuous discharge under a pulsed load resulted in a considerable loss of capacity. A white deposit containing oxide, sulfate, and some carbonate was found in these cells at the anode-to-case contact. DOE

N80-31957# Sandia Labs., Albuquerque, N. Mex. Aerodynamics Dept.

AERODYNAMIC PERFORMANCE OF A 5-METRE-DIAMETER DARRIEUS TURBINE WITH EXTRUDED ALUMINUM NACA-0015 BLADES

Robert E. Sheldahl, Paul C. Klimas, and Louis V. Feltz Mar. 1980 41 p refs

(Contract EY-76-C-04-0789)

(SAND-80-0179) Avail: NTIS HC A03/MF A01

A 5 metric-diameter vertical-axis wind turbine with extruded aluminum blades of NACA-0015 airfoil cross section was tested. Several turbine rotational speeds are presented and compared with earlier test results. Performance comparison is made with a vortex/lifting line computational code. DOE

N80-31958# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.

AUTOMATIC-CONTROL SYSTEM FOR THE 17-METRE VERTICAL AXIS WIND TURBINE (VAWT)

Gerald M. McNerney Mar. 1980 49 p refs

(Contract EY-76-C-04-0789)

(SAND-78-0984) Avail: NTIS HC A03/MF A01

An automatic control system was designed and implemented to study automatic control of a vertical axis wind turbine (VAWT) and to better judge the fatigue life and reliability of the VAWT under what will be normal operating conditions for power production. This system, including the necessary hardware, is discussed in detail along with a simplified cost analysis. DOE

N80-31959# Los Alamos Scientific Lab., N. Mex.

PASSIVE SOLAR SPACE HEATING

J. Douglas Balcomb 1980 11 p refs Presented at the Am. Sect. of the ISES Conf., Phoenix, Ariz., 2 Jun. 1980

(Contract W-7405-eng-36)

(LA-UR-80-1076; CONF-800604-11) Avail: NTIS HC A02/MF A01

An overview of passive solar space heating is presented. Trends in design, new developments, performance measures, analytical design aids, and monitored building results are given. DOE

N80-31960# Little (Arthur D.), Inc., Cambridge, Mass.

LARGE WIND TURBINE GENERATOR PERFORMANCE ASSESSMENT Technology Status Report

W. A. Vachon Jan. 1980 90 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 1348-1)

(EPRI-AP-1317; TSR-1) Avail: NTIS HC A05/MF A01

Large wind turbine generator development and field test activities are presented. An approach for gathering, distilling, and assessing WT test data is presented, with emphasis on the usefulness of the data to the industry. DOE

N80-31961# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.

DEVELOPMENT OF ADVANCED BATTERIES FOR UTILITY APPLICATION Interim Report, 1 Sep. 1977 - 30 May 1979

S. P. Mitoff Feb. 1980 345 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 128-4; EPRI Proj. 128-5)

(EPRI-EM-1341) Avail: NTIS HC A15/MF A01

Sodium-sulfur batteries for utility load-leveling applications are considered. Safety tests demonstrated the need for a safety insert for the sodium to limit the rate sodium and sulfur could react in the event of a beta tube failure. Performance testing demonstrated a cell capacity greater than the 168 Ah design value, but the electrical resistance was approximately 30% greater than the design value. Two concepts for a 100 kWh battery module were investigated. The first uses forced-convection nitrogen cooling. The second uses liquid organic coolant and is more compact and less costly, and provides better temperature control. However, the organic coolant design introduces potential fire hazards and corrosion concerns. A model was developed and experiments were performed to characterize the performance of the resistive mat between the polysulfides and the ceramic electrolyte. Also, a new measurement of the entropy change associated with the sodium-sulfur reaction was completed. DOE

N80-31962# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.

GALLIUM ARSENIDE SOLAR CELLS FOR VERY HIGH CONCENTRATION SYSTEMS: RECENT RESULTS, PROBLEMS AND EXPECTATIONS [CELLE SOLARI AL-L'ARSENIURO DI GALLIO PER SISTEMI AD ALTISSIMA CONCENTRAZIONE: RISULTATI RECENTI, PROBLEMI E PROSPETTIVE]

G. Guarini Oct. 1979 12 p refs In ITALIAN Presented at Conf. on Conversione Foltovoltaica dell'Energia Solar, Milan,

18-19 Oct. 1979
(CISE-1518) Avail: NTIS HC A02/MF A01

The state-of-the-art of solar cell research for use under highly concentrated solar radiation is reviewed. The application of GaAlAs-GaAs cells, systems using thermal recovery, and research on multi-energy levels are discussed. It is concluded that high concentration systems based on GaAlAs multicolor cells with efficiency over 30% appear to be attractive and economically feasable solutions. The three junction monolithic cell (efficiency 40-45%) is an important research goal.
Author (ESA)

N80-31963*# New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL HEATING AND COOLING. A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Progress Report, Apr. - Jun. 1979
Mike Arenson Aug. 1979 207 p
(Contract NASw-2936)
(NASA-CR-163535; PB80-174030; TAC-STHC-79-002) Avail: NTIS HC $27.50/MF $27.50 CSCL 13A

This bibliographic series cites and abstracts the literature and technical papers on the heating and cooling of buildings with solar thermal energy. Over 650 citations are arranged in the following categories: space heating and cooling systems; space heating and cooling models; building energy conservation; architectural considerations, thermal load computations; thermal load measurements, domestic hot water, solar and atmospheric radiation, swimming pools; and economics.
GRA

N80-31964*# New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL COMPONENTS. A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, Jan. - Mar. 1979
William R. Bozman, ed. Jun. 1979 86 p
(Contract NASw-2936)
(NASA-CR-163448; PB80-115249; TAC-STHC-79-001) Avail: NTIS HC $27.50/MF $27.50 CSCL 10A

This bibliographic series cites and abstracts literature and technical papers on components applied to solar thermal energy utilization. The quarterly volumes are divided into ten categories: material properties; flat plat collectors; concentrating collectors; thermal storage; heat pumps; coolers and heat exchangers; solar ponds and distillation; greenhouses; process pleat; and irrigation pumps. Each quarterly volume is compiled from a wide variety of data bases, report literature, technical briefs, journal articles and other traditional and non traditional sources. The Technology Application Center maintains a library containing many of the articles and publications referenced in the series.
GRA

N80-31965# National Technical Information Service, Springfield, Va.
WIND POWER. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - May 1980
Audrey S. Hundemann Jun. 1980 145 p Supersedes NTIS/PS-79/0534; NTIS/PS-78/0416
(PB80-811458; NTIS/PS-79/0534; NTIS/PS-78/0416) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

The feasibility, use and engineering aspects of wind power and windmills are discussed in these citations of Federally funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analyses of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. This updated bibliography contains 135 abstracts, 112 of which are new entries to the previous edition.
GRA

N80-31966# Patent and Trademark Office, Washington, D. C. Office of Technology Assessment and Forecast.
PATENT PROFILES: SOLAR ENERGY
Jan. 1980 195 p
(PB80-190010) Avail: NTIS HC A09/MF A01 CSCL 10A

Profiles of United States patenting in five major areas of solar energy technology, and in the related areas of wind, geothermal and tide and wave energy are presented. A list of assignees ranked by the number of patents in the technology to which they held title at the time of the patent grant is provided. Assignees are listed alphabetically followed by a numerical listing of patents to which they held title at the time of patent grant.
GRA

N80-31967# Utah Water Research Lab., Logan. Coll. of Engineering.
DESIGN OF A COST EFFECTIVE SOLAR POWERED WATER PUMP
Duane G. Chadwick Apr. 1980 44 p refs
(Contract DI-14-34-0001-8047)
(PB80-182819; UWRL/H-80-02; WB0-05011; OWRT-A-036-UTAH-1) Avail: NTIS HC A03/MF A01 CSCL 13K

The basic design consists of an expanding gaseous piston confined inside a chamber which is located in series with, and between, an inlet and an outlet check valve. The gas is generated by volatilizing cyclopentane or hexane. Four variations of this basic design concept were built and evaluated. Considerations in the choice of a cost effective solar collector are also reviewed. A 70 C heat source temperature is required to operate the pump if cyclopentane is used as the volatile fluid, 90 C is required if hexane is used. The pumps have a capacity of approximately 6 liters/minute when pumped to a height of 2 meters. Two square meters of sunshine are sufficient to operate the pump.
GRA

N80-31968# Dartmouth Coll., Hanover, N.H. Resource Policy Center.
INTERACTIONS BETWEEN ENERGY SUPPLY AND TRANSPORTATION-RELATED ENERGY USE, VOLUME 1 Final Report
Thomas J. Adler, John W. Ison, and Jay C. Geinzer Jan. 1980 177 p refs
(Contract DOT-RC-82003)
(PB80-185002; DOT/RSPA/DPB-50-80-7) Avail: NTIS HC A09/MF A01 CSCL 10A

The structure of ENTRANS and some of its policy analysis applications are described. ENTRANS is a computer simulator model of the interactions between energy supply and transportation related energy use. It includes a complete representation of the characteristics of transportation supply (public transit, carpooling, highways, and autos) and of households' travel related decisions (car type, travel mode, trip length, and frequency choices). The model is capable of analyzing a wide range of policies designed to change automobile fuel use. The results of several detailed policy analyses are described.
GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-31969*# University of Central Florida, Orlando. Dept. of Biological Sciences.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS (STS) AT JOHN F. KENNEDY SPACE CENTER. VOLUME 4: THREATENED AND ENDANGERED SPECIES OF THE KENNEDY SPACE CENTER. PART 1: MARINE TURTLE STUDIES Final Report, 1976 - 1979
L. M. Ehrhart Sep. 1980 417 p refs
(Contract NAS10-8986)
(NASA-CR-163122-Vol-4-Pt-1; TR-51-2-Vol-4Pt-1) Avail: NTIS HC A18/MF A01 CSCL 13B

The status of marine turtle populations in the KSC area was studied using data from previous results from ground and aerial surveillance conducted from 1976 to April 1979. During ground surveillance, various data were recorded on emergent turtles such as: species, weight, tag number (if previously tagged), time discovered, activity at discovery and the location of discovery. Observations were also made on nesting and reproductive characteristics, population estimates, immigration and emigration and growth rate of the turtles. Mortality studies were additionally made and autopsies performed on dead turtles found in the area. It is concluded that further mortality documentation should be done just prior to and just after a future space launch operation

in order to accurately assess the cause and effect relationship of such a launch on the turtle population. A.R.H.

N80-31970*# University of Central Florida, Orlando. Dept. of Biological Sciences.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS (STS) AT JOHN F. KENNEDY SPACE CENTER. VOLUME 4: THREATENED AND ENDANGERED SPECIES OF THE KENNEDY SPACE CENTER. PART 2: THREATENED AND ENDANGERED BIRDS AND OTHER THREATENED AND ENDANGERED FORMS Final Report, Sep. 1976 - Apr. 1979
L. M. Ehrhart Sep. 1980 148 p refs
(Contract NAS10-8986)
(NASA-CR-163122-Vol-4-Pt-2; TR-51-2-Vol-4-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 06C

Data are presented which were collected by ground and aerial surveillance of 37 species of birds observed within the environs of KSC which are on lists of rare and endangered biota in Florida. Additional information was obtained on other threatened species such as the West Indian manatee, the salt marsh snake, the Indigo snake, the Gopher tortoise, the American alligator, and the Florida mouse. Results of the literature search were used to obtain a historical perspective and aid in the analysis of the field data collected. A.R.H.

N80-31971*# Alabama Univ. in Huntsville. School of Science and Engineering.
NUMERICAL SIMULATION OF ADVECTION FOG FORMATION ON MULTI-DISPERSE AEROSOLS DUE TO COMBUSTION-RELATED POLLUTANTS Final Report
R. J. Hung and G. S. Liaw Jul. 1980 118 p refs
(Contract NAS8-31729)
(NASA-CR-161566; UAH-RR-248) Avail: NTIS HC A06/MF A01 CSCL 13B

The effects of multi-disperse distribution of the aerosol population are presented. Single component and multi-component aerosol species on the condensation/nucleation processes which affect the reduction in visibility are described. The aerosol population with a high particle concentration provided more favorable conditions for the formation of a denser fog than the aerosol population with a greater particle size distribution when the value of the mass concentration of the aerosols was kept constant. The results were used as numerical predictions of fog formation. Two dimensional observations in horizontal and vertical coordinates, together with time-dependent measurements were needed as initial values for the following physical parameters: (1)wind profiles; (2) temperature profiles; (3) humidity profiles; (4) mass concentration of aerosol particles; (5) particle size distribution of aerosols; and (6) chemical composition of aerosols. Formation and dissipation of advection fog, thus, can be forecasted numerically by introducing initial values obtained from the observations. T.M.

N80-31972# Mission Research Corp., Santa Barbara, Calif.
THE INCREASED ATTACHMENT DUE TO IONIZATION INDUCED SMOG IN EMP ENVIRONMENTS Final Report, 1 Apr. 1977 - 31 Oct. 1979
Murray Scheibe 31 Oct. 1979 37 p refs
(Contract DNA001-77-C-0224)
(AD-A087850; AD-E300859; MRC-R-532; DNA-5077F) Avail: NTIS HC A03/MF A01 CSCL 07/1

The increased electron attachment due to HNO3 production in the EMP source region is investigated. The HNO3 produced is found to be roughly linear with the total ionization up to an ionization value of about 2 x 10 to the 16th power ion pairs. Above this, the HNO3 production is less than linear. Although the attachment to HNO3 was not enough to explain the lightning strokes in the Mike shot, it can affect the field in the EMP source region. The attachment to other species via endothermic reactions which involve electrons which have been heated by the electric field was also investigated. It was concluded that only those reactions in which the energy change is small, such as the reactions with O3 and HNO2 and H2O2, hold much hope of contributing significantly to the overall attachment. The necessary experimental data for these reactions, however, is not available. GRA

N80-31973# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.
REMOTE SENSING PROCEDURES FOR DETECTING AND MONITORING VARIOUS ACTIVITIES REGULATED BY THE MOBILE DISTRICT Final Report, Oct. 1976 - Sep. 1978
Horton Struve and William L. Kirk Apr. 1980 397 p refs
(AD-A087584; WES/TR/EL-80-1) Avail: NTIS HC A17/MF A01 CSCL 14/5

The objective of this study was to develop procedures for use by the U.S. Army Engineer District, Mobile, to detect and monitor activities requiring a Corps of Engineers permit pursuant to Section 404 of the Federal Water Pollution Control Act Amendments of 1972, Section 10 of the River and Harbor Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. The detection and monitoring procedures developed in this study included three methods of acquiring remotely sensed data: satellite and aircraft borne digital scanner methods and airborne photographic methods. The two digital scanner systems investigated for the study were the LANDSAT Multispectral Scanner System and the National Aeronautics and Space Administration Modular Multispectral Scanner. The equipment and procedures used in these systems, which obtain the type of information required by the Regulatory Functions Branch, Mobile District, are described. Aerial photographic systems are described, and examples of several applications of detection and monitoring procedures involving wetlands, waterbodies, and structures are given. A summary of available remote sensing imagery from Federal and State agencies is given. GRA

N80-31974# Los Alamos Scientific Lab., N. Mex. Enviornmental Surveillance Group.
LASL EXPERIENCE IN DECONTAMINATION OF THE ENVIRONMENT
A. John Ahlquist 1979 19 p refs Presented at the Environ. Decontamination Workshop, Oak Ridge, Tenn., 4 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-80-926; CONF-791234-2) Avail: NTIS HC A02/MF A01

Land area surveys for radioactive contamination are reviewed. Cleanup of lands considered to have unacceptable levels of radioactive contamination is described. DOE

N80-31975# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK Progress Report, Feb. 1980
Feb. 1980 221 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-80/02) Avail: NTIS HC A10/MF A01

The network consits of (1) sensors which measure key performance parameters at a selected site; (2) a Site Data Acquisition System (SDAS); (3) telephone transmission circuits; and (4) a Central Data Processing System (CDPS). Sensor data are collected and stored on a cassette tape in the SDAS. The CDPS collects and processes the information and performs the required computations. For the majority of parameters, raw data is collected approximately every five minutes. Solar insolation and certain other parameters, which are subject to rapid variance, are sampled every 32 seconds. The CDPS interrogates each SDAS on a daily basis and retrieves all accumulated data. At the conclusion of data retrieval, the SDAS Cassette is reset by command from the CDPS for continuing data collection. Environmental information collected at the sites for the reporting month are presented. Only those sites for which the data are found to be valid are reported. DOE

N80-31976# Aspen Inst. for Humanistic Studies, Boulder, Colo.
PROSPECT OF A GLOBAL WARMING AND STUDIES OF ITS SOCIETAL IMPACTS
William W. Kellogg 1979 16 p refs Presented at the 7th Global Modeling Conf., Laxenburg, Austria, 2-5 Oct. 1979 Prepared in cooperation with National Center for Atmospheric Research, Boulder, Colo.
(Contract DE-AC02-79EV-10281)
(CONF-7910158-1) Avail: NTIS HC A02/MF A01

Discussion of a significant climate change in the near future as a result of the continued burning of fossil fuel is presented.

The major components of the program that will need to be undertaken to assess the economic and societal adjustments resulting from climatic change are outlined. DOE

N80-31977# Oak Ridge National Lab., Tenn. Health and Safety Research Div.

ANALYSIS OF COAL-DERIVED PRODUCTS AND ENVIRONMENTAL SYSTEMS BY SYNCHRONOUS FLUORESCENCE AND ROOM TEMPERATURE PHOSPHORESCENCE

T. Vo-Dinh and R. B. Gammage 1980 7 p refs Presented at the Symp. on Instrumentation and Control for Fossil Energy Processes, Virginia Beach, Va., 9 Jun. 1980

(Contract W-7405-eng-26)

(CONF-800602-4) Avail: NTIS HC A02/MF A01

Two simple room temperature techniques, synchronous fluorescence and phosphorescence, were utilized to determine the polynuclear aromatic (PNA) compounds in various complex systems including synthetic multicomponent mixtures and real life samples such as workplace air particulate extracts and coal derived samples. The results demonstrate that as many as a dozen PNA compounds can be identified and quantified by these two analytical methods. DOE

N80-31978# Los Alamos Scientific Lab., N. Mex.

EFFECTIVE TRANSPORT VELOCITY AND PLUME ELONGATION IN NOCTURNAL VALLEY WIND FIELDS

W. E. Clements, S. Barr, and M. M. Fowler 1980 7 p refs Presented at 2nd Joint Conf. on Appl. of Air Pollution Meteorol., Am. Meteorol. Soc., New Orleans, 24-27 Mar. 1980

(Contract W-7405-eng-36)

(LA-UR-80-791; CONF-800327-8) Avail: NTIS HC A02/MF A01

Using three atmospheric tracers, the effective transport velocity and plume elongation produced by nocturnal drainage wind in three different valleys were investigated. Tracer was released in each valley in a well defined drainage wind field and sequentially sampled at downvalley locations. The effective transport velocity was determined from the elapsed time from the start of the release to the time when the plume concentration reached 10% of its peak value and the distance from the release site. The plume elongation factor was determined from the ratio of the width (time) of the plume at 10% of its peak value to the duration of the release. Mean measured winds were computed from surface wind instruments along the drainage flow path with values weighted by the estimated time the plume was in the wind field best represented by a measurement. DOE

N80-31979# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A COMPUTER PROGRAM FOR THE SCATTERING OF A POLLUTANT [UN PROGRAMME DE CALCUL DE LA DISPERSION D'UN POLLUTANT]

A. Foussat 1979 21 p refs In FRENCH Presented at Intern. Assoc. for Hydraulic Res. Seminar on Les Refrigerants Atmospheriques, Chatou, France, 13-14 Nov. 1978

(VKI-Preprint-1979-4) Avail: NTIS HC A02/MF A01

A computer program for atmospheric diffusion in the presence of a pollutant with a density different from that of air is presented. This program is chiefly aimed at the prediction of gas concentrations near large buildings. After computation of the velocity field, the scattering of a pollutant is determined in the field. However, in the case of a nonstationary velocity field, both computations may be made together. A few examples are given. Author (ESA)

N80-31980# National Technical Information Service, Springfield, Va.

ATMOSPHERIC MODELING OF AIR POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - 1978

Brian Carrigan Jun. 1980 225 p

(PB80-811623) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Lower atmospheric modeling of air pollution from both mobile and stationary sources are covered in the bibliography. Local diffusion, urban heat islands, precipitation washout worldwide diffussion, climatology, and smog are covered. Stratospheric modeling concerning supersonic aircraft is excluded. This updated bibliography contains 216 abstracts, none of which are new entries to the previous edition. GRA

N80-31981# National Technical Information Service, Springfield, Va.

ATMOSPHERIC MODELING OF AIR POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1979 - May 1980

Brian Carrigan Jun. 1980 139 p Supersedes NTIS/PS-79/0690; NTIS/PS-78/0631

(PB80-811631; NTIS/PS-79/0690; NTIS/PS-78/0631) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Lower atmospheric modeling of air pollution from both mobile and stationary sources are covered in the bibliography. Local diffusion, urban heat islands, precipitation washout, worldwide diffusion, climatology, and smog are covered. Stratospheric modeling concerning supersonic aircraft are excluded. This updated bibliography contains 130 abstracts, 88 of which are new entries to the previous edition. GRA

N80-31982# KVB Inc., Irvine, Calif. Research and Analyses Div.

DETERMINATION OF AIR POLLUTANT EMISSION FACTORS FOR THERMAL TERTIARY OIL RECOVERY OPERATIONS IN CALIFORNIA, VOLUME 1 Final Report

Harold J. Taback May 1980 92 p refs

(Contract ARB-A7-075-30)

(PB80-187594; KVB-5807-842-Vol-1; ARB-R-80/116) Avail: NTIS HC A05/MF A01 CSCL 13B

Results of a study to determine the nature and extent of air pollutants resulting from thermally enhanced oil recovery operations in California are presented. Emission factors for some of the sources of these pollutants were determined. The pollutants of concern were particulate matter, sulfur oxides, nitrogen oxides, carbon monoxide, hydrocarbons, and hydrogen sulfide. Emission factors were developed by source testing steam generators and two types of well vents, those associated with steam injection fields and those associated with in-situ combustion (or fireflood) oil recovery methods. GRA

N80-31983# KVB Inc., Irvine, Calif. Research and Analyses Div.

DETERMINATION OF AIR POLLUTANT EMISSION FACTORS FOR THERMAL TERTIARY OIL RECOVERY OPERATIONS IN CALIFORNIA. VOLUME 2: APPENDIX Final Report

Harold J. Taback Nov. 1979 190 p

(Contract ARB-A7-075-30)

(PB80-187602; KVB-5807-842-Vol-2; ARB-R-79/117) Avail: NTIS HC A09/MF A01 CSCL 13B

Detailed data from tests conducted during the program is given. GRA

N80-31984# Army Cold Regions Research and Engineering Lab., Fort Wainright, Alaska. Alaskan Projects Office.

THE FATE AND EFFECTS OF CRUDE OIL SPILLED ON SUBARCTIC PERMAFROST TERRAIN IN INTERIOR ALASKA Final Report, 1975 - 1979

L. A. Johnson, E. B. Sparrow, T. F. Jenkins, C. M. Collins, C. V. Davenport, and T. T. McFadden Mar. 1980 143 p refs

(Grant EPA-IAF-D7-0794)

(PB80-187305; EPA-600/3-80-040) Avail: NTIS HC A07/MF A01 CSCL 08L

The short and long term effects of spills of hot Prudhoe Bay crude oil on permafrost terrain in subarctic interior Alaska were studied after two experimental oil spills of 7570 liters (2000 gallons) each one in winter and one in summer, on 500 sqm test plots were made at a forest site underlain by permafrost. Oil movement, thermal regime, botanical effects, microbiological responses, permafrost impact, and composition of the oil in the soil were monitored for two years. Oil movement during the winter spill occurred within the surface moss layer beneath the snow. In the summer spill, movement of the oil was primarily below the moss in the organic soil and was more rapid, moving 30 m downslope in the first 24 hours and 41 m total through the summer. The oil in the winter spill moved only 18 m downslope in the first day and stopped. Remobilization occurred in the spring allowing the oil in the winter spill to

move an additional 17 m. The total area affected by the summer spill was nearly one and one-half times as large as the winter spill. GRA

N80-31985# Washington Univ., Seattle. Dept. of Civil Engineering.

UNIVERSITY OF WASHINGTON ELECTROSTATIC SCRUBBER TESTS: COMBINED PARTICULATE AND SO2 CONTROL Final Report, Jun. 1978 - Aug. 1979

Michael J. Pilat Nov. 1979 62 p refs

(Grant EPA-R-806035)

(PB80-182603; EPA-600/7-79-245) Avail: NTIS HC A04/MF A01 CSCL 13B

A liquor recycle system was constructed permitting the pilot plant to operate in an open or closed loop mode. All SO2 tests were run in an open loop mode using either water or Na2CO3 solution as the scrubbing liquor. Simultaneous inlet and outlet source tests using cascade impactors provided size dependent and overall mass basis particle collection efficiency data. Measured over all particle collection efficiencies were 98.99% to 99.80%, depending on scrubbing operating conditions. SO2 collection efficiencies were 8.02% to 97.41%, depending on the scrubber operating conditions, inlet SO2 concentration, and the type of scrubbing liquor used. GRA

N80-31986# Research Triangle Inst., Research Triangle Park, N. C.

POLLUTANTS FROM SYNTHETIC FUELS PRODUCTION: COAL GASIFICATION SCREENING TEST RESULTS

J. G. Cleland, S. K. Gangwal, C. M. Sparacino, R. M. Zweidinger, D. G. Nichols, and F. O. Mixon Aug. 1979 101 p refs

(Grant EPA-R-804979)

(PB80-182769; EPA-600/7-79-200) Avail: NTIS HC A06/MF A01 CSCL 13B

Coal gasification test runs were conducted in a semibatch, fixed bed laboratory gasifier in order to evaluate various coals and operating conditions for pollutant generation. Extensive analyses were performed for organic and inorganic compounds and trace elements in the tars and hydrocarbon oils, aqueous condensates, and reactor residues resulting from the gasification tests. Results are reported for sulfur species in the product gas stream, for consent decree pollutants contained as volatile organic compounds in the product gas, for phenol and related compounds in the aqueous condensate and tar/oil sample, and for polynuclear aromatic hydrocarbons species in the tar/oil. GRA

N80-31987# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

PHOTOCHEMICAL AEROSOL FORMATION: REACTIVE HYDROCARBON-NOx-SO2 SYSTEMS Final Report

Donald L. Fox, Harvey E. Jeffries, and Charles E. Feigley Dec. 1979 156 p refs Sponsored by Coordinating Research Council, Inc.

(PB80-187990; CRC-APRAC-CAPA-8-71) Avail: NTIS HC A08/MF A01 CSCL 07D

The results of an investigation of photochemical aerosol formation by 1-hexene, 1,7-octadiene, cyclohexene, cyclopentene, and toluene are reported. The experiments were conducted in the University of North Carolina outdoor aerosol chamber utilizing natural sunlight to activate the photochemical reactions in systems containing a single hydrocarbon, nitric oxide (NO), and nitrogen oxide (NO2). The effect of sulfur dioxide (SO2) on these systems was also determined. The chamber was operated as a batch chemical reactor with injections of the reactants made before sunrise, and the chemical and physical transformations were measured until approximately 1500 EDT. GRA

N80-31988# Northrop Services, Inc., Research Triangle Park, N. C.

APTI (AIR POLLUTION TRAINING INSTITUTE) COURSE 450 SOURCE SAMPLING FOR PARTICULATE POLLUTANTS. STUDENT WORKBOOK

Dec. 1979 166 p

(Contract EPA-68-02-2374)

(PB80-182439; EPA-450/2-79-007) Avail: NTIS HC A08/MF A01 CSCL 07D

Tables of nomenclature, source sampling forms, and representations of selected course visual materials are given to aid the student in his understanding of Environmental Protection Agency, Federal reference method 5 for sampling particulate matter from stationary sources. GRA

N80-31989# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

FEDERAL PLAN FOR OCEAN POLLUTION RESEARCH DEVELOPMENT AND MONITORING Working Paper, FY 1981 - 1985

Edward D. Goldberg, ed. Dec. 1979 291 p refs Presented at Workshop on Assimilative Capacity of US Coastal Waters for Pollutants, Crystal Mountain, Wash., 29 Jul. - 4 Aug. 1979

(PB80-193295; NOAA-80050709; Working-Paper-1) Avail: NTIS HC A13/MF A01 CSCL 13B

Coastal waters can assimilate certain amounts of various pollutants without being undersirably degraded. The workshop determined amounts and kinds of pollutants that could be assimilated by these nearby waters without unacceptable effects. GRA

N80-31990# North Carolina State Univ., Raleigh. Dept. of Chemical Engineering.

COAL GASIFICATION/GAS CLEANUP TEST FACILITY: VOLUME 1. DESCRIPTION AND OPERATION Final Report, Sep. 1977 - Dec. 1978

J. K. Ferrell, R. M. Felder, R. W. Rousseau, J. C. McCue, R. M. Kelly, and W. E. Willis Mar. 1980 108 p refs

(Grant EPA-R-804811)

(PB80-188378; EPA-600/7-80-046A-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 13B

An integrated fluidized-bed coal gasification reactor and acid gas removal system are described. The gasifier operates at 100 psig at up to 2000 F, and has a coal feed capacity of 50 lb/hr. The gas cleaning system contains a cyclone, a venturi scrubber, and an absorber/flash/tank/stripper system for acid gas removal. A detailed description of the plant and associated facilities, a summary of operating procedures, and results of a run for the steam oxygen gasification of a Western Kentucky No. 11 coal char are given. By following the outlined operating procedures, the plant can be brought to steady state in less than 4 hours. GRA

N80-31991# Transportation Research Board, Washington, D.C.

HIGHWAY NOISE ABATEMENT

Grant S. Anderson, Christopher W. Menge, Fred L. Hall, Harvey S. Knauer, Robert E. Armstrong, Louis F. Cohn, and Mary McLaughlin, ed. 1980 38 p refs

(PB80-190622; TRB/TRR-740; ISBN-0-309-02998-8; LC-80-17422) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Various aspects of highway noise abatement are discussed. A barrier cost reduction program and the attitudes toward noise barriers before and after construction are considered along with sound absorption treatments for highway noise barriers. The effectiveness of noise barriers is addressed, specifically those adjacent to I-95 in Philadelphia and along the Capital Beltway (I-495) in northern Virginia. A systematic method for prioritizing barrier retrofit projects for highways is described. GRA

N80-31992# Environmental Research and Technology, Inc., Westlake Village, Calif.

DEVELOPMENT OF THE ELSTAR (ENVIRONMENTAL LAGRANGIAN SIMULATOR OF TRANSPORT AND ATMOSPHERIC REACTIONS) PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL AND ITS EVALUATION RELATIVE TO THE LARPP (LOS ANGELES REACTIVE POLLUTANT PROGRAM) DATA BASE

A. C. Lloyd, F. W. Lurmann, D. G. Godden, J. P. Hutchins, A. Q. Eschenroeder, and R. A. Nordsieck Sep. 1979 570 p refs

(PB80-188139; ERT/P-5287-500; CRC-APRAC-CAPA-12-72-DB) Avail: NTIS HC A24/MF A01 CSCL 13B

The data analysis and model development work performed to create and validate ELSTAR (Environmental Lagrangian Simulator of Transport and Atmospheric Reactions), a photochemical trajectory model for the prediction of ozone and nitrogen dioxide concentrations are discussed. A description of the stepwise

development and testing of the model, a discussion of the test results, recommendations for future field programs, a discussion of the model's limitations, and a recommended procedure to be followed in subsequent ELSTAR applications are included. GRA

N80-31993# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemical and Environmental Engineering.
RELATIONSHIP BETWEEN SPECIFIC NON-METHANE HYDROCARBONS AND OZONE IN AMBIENT AIR AND THEIR ROLE IN TRANSPORTATION CONTROL STRATEGIES Final Report, Jul. 1977 - Oct. 1978
E. R. Altwicker and F. DiCesare Sep. 1979 139 p refs
(Contract DOT-OS-70070)
(PB80-184922; JBA32-F; DOT-RSPA-DPB-50-79-25) Avail: NTIS HC A07/MF A01 CSCL 13B

Specific nonmethane hydrocarbon concentrations in ambient air were measured in two urban regions: New York City and the Albany/Troy/Schenectady area. A total of forty three hydrocarbons were identified via gas chromatography. Ambient sampling results were coupled with emission inventory information to generate a hydrocarbon source reconciliation to relate automotive and stationary source emissions to ambient air quality. Models that relate hydrocarbons and nitric oxide to ozone formation were reviewed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-31994*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF UPPER ATMOSPHERE DYNAMICS Final Report
R. G. Roper and H. D. Edwards Jul. 1980 90 p refs
(Grant NGL-11-002-004; Proj. E-16-605)
(NASA-CR-163519) Avail: NTIS HC A05/MF A01 CSCL 04A

A brief overview of the significant contributions made to the understanding of the dynamics of the Earth's upper atmosphere is presented, including the addition of winds and diffusion to the semi-empirical Global Reference Atmospheric Model developed for the design phase of the Space Shuttle, reviews of turbulence in the lower thermosphere, the dynamics of the equatorial mesopause, stratospheric warming effects on mesopause level dynamics, and the relevance of these studies to the proposed Middle Atmosphere Program (1982-85). A chronological bibliography, with abstracts of all papers published, is also included. L.F.M.

N80-31995*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC PARTICULATE ANALYSIS USING ANGULAR LIGHT SCATTERING
Mark Z. Hansen [1980] 40 p refs Submitted for publication
(NASA-TM-81112) Avail: NTIS HC A03/MF A01 CSCL 04A

Using the light scattering matrix elements measured by a polar nephelometer, a procedure for estimating the characteristics of atmospheric particulates was developed. A theoretical library data set of scattering matrices derived from Mie theory was tabulated for a range of values of the size parameter and refractive index typical of atmospheric particles. Integration over the size parameter yielded the scattering matrix elements for a variety of hypothesized particulate size distributions. A least squares curve fitting technique was used to find a best fit from the library data for the experimental measurements. This was used as a first guess for a nonlinear iterative inversion of the size distributions. A real index of 1.50 and an imaginary index of -0.005 are representative of the smoothed inversion results for the near ground level atmospheric aerosol in Tucson. Author

N80-31996*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR NEPHELOMETER FOR ATMOSPHERIC PARTICULATE STUDIES
Mark Z. Hansen and W. H. Evans [1980] 31 p refs Submitted for publication
(NASA-TM-81113) Avail: NTIS HC A03/MF A01 CSCL 04A

A polar nephelometer for use in studying atmospheric aerosols was developed. The nephelometer detects molecular scatter from air and measures scattering from very clean air using pure molecular scattering for calibration. A compact system using a folded light path with an air cooled argon laser for the light source was designed. A small, sensitive detector unit permits easy angular rotation for changing the scattering angle. A narrow detector field of view of + or - 1/4 degree of scattering along with a single wavelength of incident light is used to minimize uncertainties in the scattering theory. The system is automated for data acquisition of the scattering matrix elements over an angular range from 2 degrees to 178 degrees of scattering. Both laser output and detector sensitivity are monitored to normalize the measured light scattering. S.F.

N80-31997# Naval Postgraduate School, Monterey, Calif.
VERIFICATION OF THE BULK MODEL FOR CALCULATIONS OF THE OVERWATER INDEX OF REFRACTION STRUCTURE FUNCTION, (C SUB N)2
K. L. Davidson, G. E. Schacher, C. W. Fairall, D. E. Spiel, and E. C. Rittenden Jul. 1980 45 p refs
(AD-A087097; NPS61-80-016) Avail: NTIS HC A03/MF A01 CSCL 04/1

Overwater measurements of mean and fluctuating meteorological parameters have been made coincident with optical scintillation measurements. These data have been used to verify the NPS bulk aerodynamics model for calculating the index of refraction structure function, (C sub N)-squared. The average disagreement between calculated and measured values was 33% verifying the validity of the model. IR measured sea surface temperatures cannot be used in the model and this is discussed. GRA

N80-31998# Arcon Corp., Waltham, Mass.
IONOSPHERIC MODELING AND PROPAGATION ANALYSIS Final Technical Report, Nov. 1976 - Sep. 1979
David C. Miller and Joseph Gibbs Apr. 1980 75 p
(Contract F19628-77-C-0051; AF Proj. 2305)
(AD-A087259; RADC-TR-80-29) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes several studies and the development of computer techniques toward improving the capability of predicting and assessing HF propagation through the ionosphere. These studies included the development of vertical electron density models which can accurately represent observed oblique and vertical ionograms. These models have been represented by a series of functions which describe the individual ionospheric layers and which are analytically integratable to yield expected ray path trajectories. A computer program has been written which incorporates these features and yields results which are two orders of magnitude faster than those available using conventional numerical ray tracing techniques. The technique has been applied to several studies including the simulation of the backscatter leading edge of oblique ionograms and the determination of HF circuit parameters for a specified ground coverage. The results are presented as a function of the change in individual ionospheric layer parameters. GRA

N80-31999# HSS, Inc., Bedford, Mass.
TIME DELAY OF TERRESTRIAL LIGHT PULSES PROPAGATING THROUGH CLOUDS TO SATELLITE SYSTEMS Final Report, 1 Apr. 1977 - 30 Sep. 1979
H. S. Stewart and L. B. Woolaver Patrick AFB, Fla. AFTAC 7 Jul. 1980 203 p refs
(Contract F08606-77-C-0024)
(AD-A087242; HSS-B-058; AFTAC-TR-80-23) Avail: NTIS HC A10/MF A01 CSCL 08/5

A method is described and applied for interpreting optically filtered all sky photographs so as to generate curves of the time dependent probability that a photon emitted by an isotropic source near the Earth's surface will reach a satellite at any elevation and azimuth in the sky. Two basic concepts are involved:

first that the probability at lambda = 0.76 microns for absorption of light by atmospheric oxygen is proportional to the square root of the dwell time of the light in the atmosphere, and second, that a time dependent reciprocity theorem exists allowing observations of the skylight incident on a ground based detector to be interpreted in terms of the probability that a photon starting at the detector can reach a satellite in the direction of the Sun. Detailed theory and operating equations were developed and appropriate equipment was built and operated. Computerized reduction of microdensitometer scans of the all sky photographs led to values of mean time delay and transmission for 125000 equal elements of solid angle in the sky. These were summed to generate the time dependent probability. Photographs made at Kennedy Space Center were used to generate delay curves for seven satellite directions on nine separate occasions. M.G.

N80-32000# Emmanuel Coll., Boston, Mass.
MODELLING OF EQUATORIAL PHASE AND AMPLITUDE SCINTILLATIONS FROM OGO-6 AND AE IRREGULARITY DATA Scientific Report, 1 Mar. 1978 - 28 Feb. 1979
Sunanda Basu and Santimay Basu Hanscom AFB, Mass. AFGL Nov. 1979 29 p refs
(Contract F19628-78-C-0005; AF Proj. 4643)
(AD-A087011; AFGL-TR-80-0141; SR-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

The technique of modelling equatorial phase and amplitude scintillations from in situ measurements of irregularity amplitude, ambient ionization density and irregularity power spectrum is outlined. The in situ measurements do not directly provide information on irregularity layer thickness for which radar backscatter observations are utilized. The equatorial scintillation models developed from OGO-6 and AE-C in situ measurements during the two solstices are presented. Considerable differences in the longitude variation of scintillations are predicted during the two solstices. The model estimates are in good agreement with the available ground based phase and amplitude measurements. Problems associated with the use of bottomside spread-F data for transionospheric propagation modelling at VHF/UHF are also discussed. GRA

N80-32001# Physical Dynamics, Inc., La Jolla, Calif.
STABILITY OF BOUNDARY LAYER FLOW Final Report, 11 Sep. 1979 - 31 Jan. 1980
B. E. Freeman and L. E. Hauser Mar. 1980 89 p refs
(Contract N00173-79-C-0302)
(AD-A087028; PD-JL-80-220) Avail: NTIS HC A05/MF A01 CSCL 04/1

A technique is developed and applied for the evaluation of conditions under which marine boundary layers are unstable, and for computing the rate of growth of unstable motions. Linear perturbation equations are formulated which account for influence of wind shear, static stability, Coriolis force, turbulent diffusion, large scale convergence, and geostrophic wind on linear stability. The mean quantities can be prescribed by analytic functions or supplied as numerical tables derived either from observed/specified data or a boundary layer model. The linearized model is solved as a generalized eigenvalue problem. Related calculations with the SIGMET code are discussed, including radar properties of the marine boundary layer. GRA

N80-32002# Naval Research Lab., Washington, D. C. Plasma Physics Div.
QUASILINEAR SCATTERING FROM WAVES DRIVEN BY BEAM-PLASMA INSTABILITIES Interim Report
S. H. Brecht (Science Applications, Inc., McLean, Va.) and P. J. Palmadesso 21 Apr. 1980 35 p refs Sponsored by DNA
(AD-A087208; AD-E000474; NRL-MR-4203) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Starfish southern conjugate rebrightening is explained by velocity diffusion perpendicular to the Earth's magnetic field line. The diffusion is caused by particle scattering off of the harmonics of ion cyclotron waves commonly called Bernstein modes. Quasilinear estimates of the wave fluctuation levels indicate that the debris streaming down the field lines will excite these waves and then be scattered by them. GRA

N80-32003# Naval Research Lab., Washington, D. C.
NONLINEAR EVOLUTION OF DIFFUSE AURORAL F REGION IONOSPHERIC IRREGULARITIES Interim Report
M. J. Keskinen (Berkeley Research Associates, Arlington, Va.), S. L. Ossakow, and B. E. McDonald 2 Jul. 1980 28 p refs Sponsored by DNA and ONR
(IRR0330244)
(AD-A086998; AD-E000491; NRC-MR-4248) Avail: NTIS HC A03/MF A01 CSCL 04/1

Numerical simulations of the nonlinear evolution of the current convective instability in the diffuse aurora have been performed for conditions typical of the nighttime high latitude F region. Our results show nearly field aligned plasma irregularities developing in regions of well defined northward gradients of total electron content (TEC) and field-aligned diffuse auroral particle precipitation. In addition, we find equatorward movement of plasma enhancements and northward (poleward) movement of plasma depletions (holes). Furthermore, one dimensional spatial power spectra of the irregularities in both the north-south and east-west directions are well described by inverse laws. GRA

N80-32004# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
MAGNETOSPHERIC AND INTERPLANETARY ELECTROSTATICS: A SIMPLE BUT EXPLICIT MODEL Final Interim Report
Michael Schulz 1 Jul. 1980 10 p refs
(Contract F04701-79-C-0080)
(AD-A087110; TR-0080-5505-02-1; SD-TR-80-44) Avail: NTIS HC A02/MF A01 CSCL 04/1

This is a generalization of Dungey's 1961 model for the prototype of an 'open' magnetosphere. The magnetic-field lines are traced by superimposing a uniform B field parallel to the geomagnetic dipole axis. There results a quasi-cylindrical separatrix (the 'magnetopause') between field lines that intersect the Earth and those that do not. However, the magnetic field outside the magnetosphere can be multiplied by an arbitrary factor (positive or negative) without altering the field-line geometry. Any discontinuity in B at the 'magnetopause' is supported by azimuthal currents there. The electrostatic problem is asymptotically analogous to that of a dielectric cylinder in an asymptotically uniform electric field (which owes its origin to the solar wind in this case). It is easy to map from the asymptotic solution inward and equatorward, since the magnetic field lines are treated as electric equipotentials. The tangential component of the electric field is continuous at the magnetopause but varies between limits that correspond to the 'open' and 'closed' models of the magnetosphere, as defined by the access of interplanetary plasma. GRA

N80-32005# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CAD: A CODE FOR THE CALCULATION OF ATMOSPHERIC DENSITY
William L. Oliver 2 Apr. 1980 26 p refs
(Contract F19628-80-C-0002; AF Proj. 2129)
(AD-A087447; TN-1980-20; ESD-TR-80-28) Avail: NTIS HC A03/MF A01 CSCL 04/1

An efficient machine implementation of the 1972 COSPAR International Reference Atmosphere (CIRA) is developed for use in evaluating atmospheric drag effects upon earth orbiting satellites. Restriction of this procedure to the satellite orbit region of significant drag and the use of an alternate temperature profile representation have enabled a factor of 30 improvement in machine execution time compared with that required by the code supplied by CIRA publication while incurring only a few percent difference in the density results. GRA

N80-32006# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE INVESTIGATION OF THE MAGNETOSPHERIC DYNAMICS IN CONJUNCTION WITH THE SCATHA SATELLITE OBSERVATIONS Final Report, 1 Oct. 1978 - 30 Sep. 1979
Ching-I. Meng Dec. 1979 140 p refs
(Contract N00014-72-C-4401)
(AD-A087433; AFGL-TR-80-0070) Avail: NTIS HC A07/MF A01 CSCL 08/14

This task consists of two parts. The first part concerns (a) the collection and analysis of ground based and satellite data for

the purpose of monitoring the magnetospheric conditions in support of the SCATHA satellite activity at Air Force Geophysics Laboratory, and (b) the technical support in the study of the particle and field data returned by SCATHA satellite. The second part is to analyze observations of auroral phenomena made by satellites of the USAF Defense Meteorological Satellite Program. The effort at APL/JHU for the first part of this task was majorly in the role of providing supports to the SCATHA activity and for the second part of DMSP observations was in the understanding of polar region auroral phenomena. Therefore, this final report is divided into a summary of efforts supporting SCATHA and scientific results from analyzing DMSP data. The former consists of (1) a short description of why and how the ground based magnetic data can be used in monitoring the magnetospheric conditions and (2) a list of data collected together with a guide for using these data. The latter contains (1) a list and abstracts of all scientific reports and journal articles published or submitted for publication, during this reporting period, with at least partial sponsorship attributed to AFGL, and (2) an article concerning a possible diurnal variation of the auroral oval size. GRA

N80-32007*# Rice Univ., Houston, Tex.
QUANTITATIVE SIMULATION OF A MAGNETOSPHERIC SUBSTORM. 1: MODEL LOGIC AND OVERVIEW
M. Harel, R. A. Wolf, R. W. Spiro, P. H. Reiff, C.-K. Chen, W. J. Burke, F. J. Rich, and M. Smiddy Jan. 1980 92 p refs
(Grant NGR-44-006-137; Contract F19628-77-C-0005; Grant NSF ATM-74-21185; AF Proj. 2311)
(NASA-CR-163547; AD-A087699; AFGL-TR-80-0128; SR-2) Avail: NTIS HC A05/MF A01 CSCL 04/1

This and the following two papers report results of the first comprehensive computer simulation of the behavior of the Earth's inner magnetosphere during a substorm type event. We have developed a self consistent quantitative model to compute electric fields, currents and the resulting plasma flow in the inner-magnetosphere/ionosphere system. Dawn-dusk electric fields show a general correlation with the east-west magnetic field perturbations. Unexpectedly, two of the passed display substantial regions of sunward plasma flow poleward of the main part of the region-1 Birkeland currents. The cross-polar-cap potential drops computed from the data represent the first effort at satellite monitoring of this important parameter during various phases of a substorm, and shown an important enhancement during the substorm. Numerical results from these first-try simulations were consistent with most of the established features of convection in the inner magnetosphere. GRA

N80-32008*# Rice Univ., Houston, Tex.
QUANTITATIVE SIMULATION OF A MAGNETOSPHERIC SUBSTORM. 2: COMPARISON WITH OBSERVATIONS
M. Harel, R. A. Wolf, R. W. Spiro, P. H. Reiff, C.-K. Chen, W. J. Burke, F. J. Rich, and M. Smiddy Jan. 1980 81 p refs
(Grant NGR-44-006-137; Contract F19628-77-C-0005; Grants NSF ATM-74-21185; NSF ATM-79-20157; AF Proj. 2311)
(NASA-CR-163548; AD-A087700; AFGL-TR-80-0129; SR-3) Avail: NTIS HC A05/MF A01 CSCL 04/1

Several results of computer simulation of the behavior of the inner magnetosphere during the substorm-type event of 19 September 1976 are discussed. The model predicts a modest ring-current injection, in to about L=6. The model Birkeland currents agree satisfactorily with the averaged observations of Iijima and Potemra, in terms of direction, strength and overall pattern. The model provides a useful picture of the overall magnetosphere-ionosphere current system. The model indicates that the total Joule heating during the event is about 2-3 times the increase in ring-current energy, a result that is in apparent contradiction to some previous estimates. GRA

N80-32009# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE INFLUENCE OF ATMOSPHERIC DYNAMICS ON OZONE AND TEMPERATURE STRUCTURE
Robert O. Olsen and Jagir S. Randhawa May 1980 43 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-A087702; ERADCOM/ASL-TR-0057) Avail: NTIS HC A03/MF A01 CSCL 04/1

A two phase sounding program was undertaken at White Sands Missile Range, New Mexico, during the first week of February and June 1973 to measure upper atmosphere temperature, winds, and ozone. In situ and ground based instrumentation were used. The program was designed to investigate atmospheric transport processes occurring in the lower stratosphere and troposphere. Observations taken in January on the day following the passage of a jet stream over the station showed a large increase (30 percent) in the total ozone. Also ozone concentration increased as temperature increased at the double tropopause region. During the second phase of the study, the first week of June, the height of the tropopause moved downward approximately 3 km, from an altitude of 16 km on 1 June to 13 km on 8 June. The variations of ozone in the troposphere and temperature at tropopause altitudes corresponded with associated atmospheric circulation changes, indicating circulation influence at these altitudes. GRA

N80-32010# Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
SIZE DISTRIBUTION, CHEMICAL COMPOSITION AND OPTICAL PROPERTIES OF ATMOSPHERIC DUST IN ISRAEL: A COMPARISON OF URBAN AND DESERT AEROSOLS UNDER CLEAR AND DUSTY CONDITIONS Final Report, 1 Jul. 1978 - 1 Mar. 1980
Zev Levin Feb. 1980 73 p refs
(Grant DA-ERO-78-G-087)
(AD-A087608) Avail: NTIS HC A04/MF A01 CSCL 04/1

Measurements of aerosol size distributions, chemical composition and optical properties were carried out at two locations in Israel. Tel Aviv was chosen as an urban region and Mitzpe Ramon as a desert region. The measurements indicate that the size spectra between 0.15 - 12 micrometers can be approximated by a power law type distribution. The spectra in Tel Aviv show higher concentrations and greater slopes than those from the desert. Diurnal variations between day and night are observed in the size distribution of the summertime measurements in Tel Aviv. These are believed to be related to the increase in aerosol size due to absorption of water vapor during high relative humidity periods. The chemical composition in Tel Aviv was found to strongly depend on the meteorological conditions. The optical measurements also suggest strong differences between Tel Aviv and the desert. Filter samples of atmospheric particulate matter from Tel Aviv always appeared darker than those from the desert site. Measurements of imaginary refractive index in the 0.3 to 1.7 micrometer spectral region are presented. These measurements are consistently higher by a factor of 2 to 4 in Tel Aviv as compared to simultaneous samples from the desert site. Seasonal variations have also been observed and are believed to be primarily related to temperature inversions near or at the ground during the winter months and to the effect of pollution from Southern Europe which is carried eastward by synoptic scale motion. GRA

N80-32011# Air Force Global Weather Central, Offutt AFB, Nebraska.
SPECIAL SENSOR H (SSH) MOISTURE SOUNDING Interim Report
Richard C. Savage Mar. 1980 23 p refs
(AD-A087576; AFGWC/TN-80/001) Avail: NTIS HC A02/MF A01 CSCL 04/2

Analysis of variance in the 18-30 micrometers water vapor sensing channels of the DMSP SSH infrared sounder indicates the channels are too opaque in moist atmospheres. Their statistical influence must be carefully controlled in forming statistical inversion matrices for temperature profiles. GRA

N80-32012# Weston Observatory, Mass. Dept. of Geology and Geophysics.
INVESTIGATION OF MAGNETIC FIELD PHENOMENA IN THE IONOSPHERE Final Report, 1 Jul. 1976 - 30 Sep. 1979
John F. Devane and Edward A. Johnson Jan. 1980 58 p refs
(Contract F19628-76-C-0291; AF Proj. 7601)
(AD-A087526; AFGL-TR-80-0099) Avail: NTIS HC A04/MF A01 CSCL 08/14

Weston Observatory (Boston College) has maintained a geomagnetic observatory to continuously monitor changes in the geomagnetic field and to provide standards for magnetic instrumentation and to maintain a coil system in which a wide variety of magnetic instrumentation can be tested and calibrated to support AFGL RESEARCH. The observatories in Project MAGAF have been installed and maintained. The secular change in the geomagnetic field at Weston is detailed for the past six years. Modifications have been made in the network instrumentation to insure reliability and accuracy of the data digitally transmitted to Hanscom AFB. A three component magnetic observatory has been designed around the total field sensor. The reliability of the principal components of the network has been investigated and changes proposed for the remote observatories. GRA

N80-32013# Bureau of Mines and Geology, Moscow, Idaho. Dept. of Lands.
ADDITIONS AND CORRECTIONS TO THE BIBLIOGRAPHY OF GEOLOGIC STUDIES, COLUMBIA PLATEAU (COLUMBIA RIVER BASALT) AND ADJACENT AREAS, IN IDAHO, 1980
William Strowd and Gail S. Hustedde 1980 124 p refs
(Contract DE-AC02-77RL-01030)
(RHO-BWI-C-68) Avail: NTIS HC A06/MF A01

Materials that have become available since the original publication and pertinent literature that had originally been overlooked are included. Index maps that show locations of geologic studies and geochemical petrographic, remanent paleomagnetic, and radiometric age-dated sites within the Columbia River Basalt Group field within Idaho are presented. Archeological sites, test wells, mines, quarries, and other types of excavations are also identified. DOE

N80-32014# Sandia Labs., Albuquerque, N. Mex.
PRELIMINARY ONE-DIMENSIONAL THERMAL ANALYSIS OF WASTE EMPLACEMENT IN TUFFS
Bruce M. Bulmer and Allen R. Lappin Apr. 1980 31 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1265) Avail: NTIS HC A03/MF A01

One dimensional calculations of near field temperatures resulting from waste emplacement in a multiple layered tuff stratigraphy are presented. Results indicate a marked sensitivity of peak temperatures to assignment of in situ fluid pressure, geothermal heat flux, waste type, and location of waste relative to a specific stratigraphic discontinuity. Under the criterion that allowable initial power densities are limited by the occurrence of boiling at a distance of 10 m from emplaced waste, allowable power densities are calculated to range up to 150 kW/acre or more, depending upon geothermal heat flux and waste type. DOE

N80-32015# Royal Aircraft Establishment, Farnborough (England).
ODD ZONAL HARMONICS IN THE GEOPOTENTIAL FROM ANALYSIS OF 28 SATELLITE ORBITS
D. G. King-Hele, C. J. Brookes, and G. E. Cook London HMSO Feb. 1980 49 p refs
(RAE-TR-80023; RAE-Space-576; BR73771) Avail: NTIS HC A03/MF A01

The geopotential is usually expressed as an infinite series of spherical harmonics, and the odd zonal harmonics are the terms independent of longitude and antisymmetric about the equator they define the 'pear-shape' effect. The coefficient J3, J5, J7, ... of these harmonics were evaluated by analyzing the variations in eccentricity of 28 satellite orbits from near-equatorial to polar. Most of the orbits from previous determinations in 1973 are used again, but three new orbits are added, including two at inclinations between 62 and 63 deg, which have been specially observed for more than five years by the Hewitt cameras. With the help of the new orbits and revised theory, sets of J-coefficients with standard deviations about 40% lower than before were obtained. The accuracy of the longitude-averaged geoid profile is estimated as 50 cm, except at latitudes above 86 deg. The geoid profile and predicted amplitude of the oscillation in eccentricity are compared with those from other sources. Author (ESA)

N80-32016# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 3: SOLAR ACTIVITY PREDICTIONS
Richard F. Donnelly Mar. 1980 520 p refs Presented at the Intern. Solar-Terrest. Predictions Proc. and Workshop, Boulder, Colo., 23-27 Apr. 1979
(PB80-195001; NOAA-80050712) Avail: NTIS HC A22/MF A01 CSCL 04A

Chapter A includes the contributions on long term solar activity predictions. Most of these papers involve statistical techniques. Chapter B presents predictions of the interplanetary magnetic field. Chapter C discusses solar flare and active region predictions. Chapter D contains papers about using the optical, microwave or X-ray data to make short term predictions of the particle radiation at Earth. GRA

N80-32017# SRI International Corp., Menlo Park, Calif.
AIRBORNE MEASUREMENTS OF STRATOSPHERIC OZONE INTRUSIONS INTO THE TROPOSPHERE OVER THE UNITED STATES. VOLUME 2: DATA CATALOG Final Report
William Viezee, Warren B. Johnson, and Harwant B. Singh Sep. 1979 242 p
(SRI Proj. 6690)
(PB80-190705; CRC-APRAC-CAPA-15-76B-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 04A

A rural atmospheric data collection and analysis program for the period 8 August 1977 to 7 September 1979 was conducted. Two field programs using an instrumented aircraft were carried out to investigate the downward vertical transport of ozone rich air from the stratosphere as a potential cause of natural tropospheric ozone. A catalog of observational data is presented. GRA

N80-32018# Nebraska Univ., Lincoln. Ross Ice Shelf Project Management Office.
INITIAL REPORT ON GEOLOGICAL MATERIALS COLLECTED AT RISP SITE J9
Peter-Noel Webb Oct. 1979 136 p refs Prepared in cooperation with Univ. of Northern Illinois, De Kalb
(Contracts NSF C-1059; NSF C-726)
(PB80-188253; RISP/TR-79-1; CHC-APRAC-CAPA-8-71-7) Avail: NTIS HC A07/MF A01 CSCL 08G

Sampling of 58 cores at Ross Ice Shelf Project Site J9 was undertaken in December of both 1977 and 1978. Analysis of sea floor wave forms suggests that the northward movement of the Ross Ice Shelf in this region might be between 1 and 4 m a day. The lithological, paleontological, and stratigraphical core analyses are described. A data of 174 m.y. was obtained from Rb/Sr dating of fine grained detrital feldspars in a dredge sample of the core upper unit. GRA

N80-32019# Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
MEASUREMENT, PREDICTION, AND HAZARD EVALUATION OF EARTH FISSURES AND SUBSIDENCE, SOUTH-CENTRAL ARIZONA
James K. Boling, Jr., Michael C. Carpenter, N. M. Johnson, and S. N. Davis 1980 113 p refs
(Contract DI-14-34-0001-9003; OWRT Proj. A-092-ARIZ(1))
(PB80-183908; W80-05006) Avail: NTIS HC A06/MF A01 CSCL 08G

Earth fissuring and subsidence research in south central Arizona consisted of measurement of horizontal movements of earth fissures and mapping of erosional features and hazard evaluation of earth fissures. Records will form the data base for predictive models of subsidence and earth fissuring. Bimonthly horizontal strain measurements of fissures were made over a three year period at locations near Signal Peak, Picacho Mountains,

and in Avra Valley. Fissures opened and closed repeatedly. They exhibited relatively smooth movement with occasional sudden jumps. Fissures closed during long dry periods and opened after high rainfall. GRA

N80-32020# National Geodetic Survey, Rockville, Md.
TIDAL CORRECTIONS TO GEODETIC QUANTITIES
P. Vanicek Feb. 1980 38 p refs
(PB80-189376; NOAA-TR-NOS-83; NOAA-80043001) Avail: NTIS HC A03/MF A01 CSCL 08E

The origin of tidal force is explained and mathematically treated. Then the phenomena caused by tidal force are shown, first by viewing the Earth as rigid, and then elastic. Particular emphasis is given to the formation of corrections arising from these tidal phenomena, and the complete range of geodetic observations and corrections is included. Finally, corrections for sea tide are discussed. All tidal aspects that would be of interest to a geodesist are treated from a geodetic point of view. GRA

N80-32021# State Univ. of New York at Potsdam. Dept. of Geological Sciences.
A DETAILED MAGNETIC SURVEY OF THE SAINT LAWRENCE RIVER: OAK POINT TO LAKE ONTARIO, NEW YORK
Frank Revetta and John Cardinal 1979 43 p refs Sponsored by NOAA
(PB80-191471; NOAA-80050202) Avail: NTIS HC A03/MF A01 CSCL 08N

Measurements of the total intensity of the Earth's magnetic field in the St. Lawrence River between Oak Point and Lake Ontario indicated magnetic anomalies of high magnitude and steep gradients due to rocks of varying magnetic susceptibility in the Precambrian basement complex. The anomalies and magnetic contours that trend continuously across the river indicated no large lateral offset in this area. Also, magnetic anomalies associated with diabase dikes in the Gananoque, Ontario, and Grandstone Island areas indicated no lateral offset in that area. GRA

N80-32022# National Oceanic and Atmospheric Administration, Washington, D. C. Aeronomy Lab.
PROGRAM OF RESEARCH AND MONITORING FOR EARLY DETECTION OF STRATOSPHERIC OZONE CHANGE. REPORT TO CONGRESS OF FINDINGS FOR 1978 - 1979
Jan. 1980 47 p refs
(PB80-184021; NOAA-80041106) Avail: NTIS HC A03/MF A01 CSCL 04A

Research and monitoring of the stratosphere for the purpose of early detection of changes in the stratosphere and climatic effects of such changes is described. The findings from stratospheric research and monitoring program are applicable to issues of national concern in three broad areas: measurements from the worldwide ozone monitoring network, other measurements of significant stratospheric parameters and model calculations of stratospheric ozone behavior under continued chlorofluorocarbon release. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-32023*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INITIAL DIRECT STRIKE LIGHTNING DATA
Felix L. Pitts and Mitchel E. Thomas Aug. 1980 25 p refs
(NASA-TM-81867) Avail: NTIS HC A02/MF A01 CSCL 04B

Data waveforms of the rate of change of electric flux density obtained during two lightning strikes to an aircraft specially instrumented for lightning electromagnetic measurements are presented. The aircraft was operating in a thunderstorm environment to elicit strikes. The instrumentation system configuration, flight conditions, and strike scenario showing probable lightning path on the aircraft are described. The waveforms, which were obtained at a 10 nanosecond sample interval, indicate significant excursions of the rate of change of electric flux density occurred over few hundred nanoseconds time interval. T.M.

N80-32024# RAND Corp., Santa Monica, Calif.
ANOMALOUS SNOWFALL CAUSED BY NATURAL-DRAFT COOLING TOWERS
Randall L. Koenig May 1980 48 p refs
(Grant DE-AC03-76EV-01191)
(RAND/N-1479-DOE) Avail: NTIS HC A03/MF A01

Tabulation of a number of aerial observations of plumes at subfreezing temperatures indicates that a cooling tower plume is likely to produce measurable snow if its temperature is colder than -13 C and the saturation deficit of the ambient air is less than 0.5 g m to the -3 power. These empirically derived criteria were tested using a numerical model of cloud microphysics that simulates the most important processes of transfer of water substance between vapor, liquid, and ice, including nucleation and development of particle-size spectra. Among the many quantities computed is the flux density of snow at the base of the plume. From this, together with average fallspeed and horizontal wind speed, the amount and pattern of snowfall at the ground was computed. Comparison of the computational results with observations of actual plumes shows that the model has skill in predicting plume behavior and strongly supports the criterion of -13 C for plume snowfall, however, the maximum snowfall depth is predicted to occur nearer the source than is observed. A.R.H.

N80-32025*# Tennessee Univ. Space Inst., Tullahoma. Scientific and Technical Information Branch.
ATMOSPHERIC TURBULENCE SIMULATION TECHNIQUES WITH APPLICATION TO FLIGHT ANALYSIS Final Report
Show-Tien Wang and Walter Frost Sep. 1980 171 p refs
(Contract NAS8-32692)
(NASA-CR-3309; M-302) Avail: NTIS HC A08/MF A01 CSCL 04B

Statistical modeling of atmospheric turbulence is discussed. The statistical properties of atmospheric turbulence, in particular the probability distribution, the spectra, and the coherence are reviewed. Different atmospheric turbulence simulation models are investigated, and appropriate statistical analyses are carried out to verify their validity. The models for simulation are incorporated into a computer model of aircraft flight dynamics. Statistical results of computer simulated landings for an aircraft having characteristics of a DC-8 are reported for the different turbulence simulation techniques. The significance of various degrees of sophistication in the turbulence simulation techniques on the landing performance of the aircraft is discussed. Author

N80-32026# Weather Wing (7th), Scott AFB, Ill.
SATELLITE DERIVED WINDS
Brian E. Heckman 1 Jul. 1980 15 p refs
(AD-A087023; REPT-7WW/TN-80/002) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report explains how satellite derived winds are produced, discusses reliability and accuracy of satellite winds, possible uses, and provides instructions for decoding TWXX-series bulletins. It identifies differences in decoding procedures for U.S., Japanese, and European GOES wind bulletins, and it also provides examples of bulletins and how data may be plotted. GRA

N80-32027# TRW Defense and Space Systems Group, Redondo Beach, Calif. Engineering Sciences Lab.
ANALYTIC MODELING OF SEVERE VORTICAL STORMS Final Report, 9 Jul. 1979 - 8 Jul. 1980
Francis Fendell, Phillip Feldman, and George Carrier 8 Jul. 1980 45 p refs
(Contract N00014-79-C-0508)
(AD-A086919; TRW-35524-6001-UT-00) Avail: NTIS HC A03/MF A01 CSCL 04/2

Analytic modeling of well organized convective storms was undertaken to elucidate the evolution from a moderately intense one cell vortex--characterized by low level pressure deficits on the order of one percent of atmospheric pressure--to a very intense two cell vortex--characterized by low level pressure deficits on the order of ten percent of atmospheric pressure. The physical distinction between the two stages is the insertion of a dry,

compressionally heated, nonrotating, central downdraft of originally tropopause level air in the more severe case. The quasisteady mature description of the thermohydrodynamic structure of each vortex is being developed, and then the conditions for transition from the moderately intense to the very intense vortex are to be sought. The practical motivation is to make progress toward the highly desirable, but very formidable, task of being able to anticipate which tropical storms or minimal hurricanes will evolve to supertyphoons. Description of the two cell vortex is the current challenge. In particular, the properties and location of the eye wall are sought, since the potential vortex and surface inflow subdivisions of the structure of a very intense vortex are in hand. The modeling proceeds from basic thermohydrodynamic principles. Nonessential geometric detail, as well as association of conclusions with the details of particular parameterizations, is being avoided as much as possible. GRA

N80-32028# Texas A&M Univ., College Station. Dept. of Physics.

OCEAN-ATMOSPHERE INTERFACE: ITS INFLUENCE ON RADIATION

Gilbert N. Plass, Terry J. Humphreys, and George W. Kattawar 22 May 1980 61 p refs Submitted for publication

(Contract N00014-80-C-0113)

(AD-A087046; TR-14) Avail: NTIS HC A04/MF A01 CSCL 20/6

The influence of the ocean atmosphere interface on the radiance distribution in both the ocean and atmosphere is investigated. At visible wavelengths in the real ocean just below the surface, the downwelling radiance is a maximum within the critical angle and drops off by one or two orders of magnitude toward the horizon. The usual explanation that this is due to the sky radiation concentrated within the critical angle and the total internal reflection of the weak upward radiance at the ocean surface at angles outside the critical angle is too simplistic. There are two other important factors: (1) the atmosphere must have sufficient optical thickness so that appreciable sky (multiple scattered) radiation develops at all angles in the downward direction; and (2) the water must have appreciable absorption so that the upwelling radiance just below the ocean surface is only a small fraction of the downwelling radiance entering the ocean. The radiance distribution in a homogeneous medium is compared with that in the same medium with an atmosphere ocean interface at various depths within the medium. Most of the calculations are done for Rayleigh scattering centers, but some results are given for Mie type scattering. GRA

N80-32029# Washington Univ., Seattle. Polar Science Center.

FRAM 1 METEOROLOGY REPORT

Eric Leavitt and Roger Andersen May 1980 61 p refs

(Contract N00014-79-C-0032)

(AD-A086983) Avail: NTIS HC A04/MF A01 CSCL 04/2

The Fram experiment was conceived as a series of studies to study the geophysics and oceanographic characteristics of the eastern Arctic. The meteorological experiment was designed to provide basic data on wind velocities for the oceanographic experiments, to measure the drag coefficient of the pack ice in the area of the camp, and to collect standard weather data and transmit it to Thule for inclusion in the synoptic network and for planning flight support operations. This report describes the experiment, the data analysis procedures and the data products which are available. The time series of half hour averages of wind speed, direction, and air temperature plus the air pressure every three hours are included as an appendix. Results of the drag coefficient calculations are also included. GRA

N80-32030# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

A DEMONSTRATION TEST OF THE MODULAR AUTOMATED WEATHER SYSTEM (MAWS) Final Report, Jan. 1977 - Jan. 1979

Donald A. Chisholm, Richard H. Lynch, James C. Weyman, and Edward B. Geisler AFSC 24 Mar. 1980 85 p refs

(AF Proj. 6670)

(AD-A087070; AFGL-TR-80-0087; AFGL-IP-285) Avail: NTIS HC A05/MF A01 CSCL 04/2

A microprocessor-based automated airfield weather observing and forecasting system called MAWS (Modular Automated Weather System) was developed to demonstrate the feasibility of modernizing many of the observing and forecasting functions performed in operational base weather stations. Scott Air Force Base, Illinois, was chosen as the demonstration site and operations were conducted from January 1977 through January 1979. Weather sensors at five observation sites around the airfields were polled several times each minute, the data transmitted over commercial, voice-grade telephone lines to a central supervisory microprocessor where the data were suitably collated, averaged and formatted for display on alpha-numeric display devices at key locations and for magnetic tape archiving for post analysis. The demonstration confirmed that modernized weather support can be largely achieved with state-of-the-art, commercially available hardware/software. Such a system would be compatible with other automation efforts in civilian weather services and other C-cubed efforts in the DOD. The advantage of spatially and temporally detailed weather information in marginal and adverse situations was documented. Sensor siting considerations were addressed in relation to specific weather elements and observational requirements. The contributions of automated met watch procedures and short-range guidance forecasts of RVR landing minima were demonstrated. Feedback on system performance and acceptability was obtained from cognizant AWS offices. GRA

N80-32031# Naval Research Lab., Washington, D. C.

ICING CHARACTERISTICS OF LOW ALTITUDE, SUPERCOOLED LAYER CLOUDS Interim Report, Feb. - Oct. 1980

Richard K. Jeck May 1980 74 p refs

(Contract DOT-FA79WAI-020)

(AD-A087137; FAA-RD80-2423) Avail: NTIS HC A04/MF A01 CSCL 04/2

A limited amount of new data has been obtained on the icing environment during initial airborne measurements aimed at developing environmental icing criteria for use in certifying helicopters for flight into icing conditions. Supercooled cloud characteristics are reported for 12 icing events encountered at temperatures from -10 C to 0 C at altitudes from 3500 to 6500 ft above the surface of Lake Erie and Lake Michigan. Recorded droplet size spectra from a Particle Measuring Systems: Axially Scattering Probe (ASSP) were used to compute droplet mass (volume) median diameter (MMD) and, in addition to a Johnson-Williams LWC Indicator, the liquid water content (LWC). A review of available historical data from 1944-1950, upon which the atmospheric icing standards of Appendix C, FAR 25 were based, reveals that data obtained from measurements of ice accretion on multidiameter cylinders are subject to a number of significant errors of both signs. These probable errors, which will continue to be evaluated, may be responsible for the conclusions that (1) the historical LWC values are generally larger than those observed in the flights described in this report, (2) the historical MMDs appear to be generally too small for all values of LWC and (3) the historical droplet size distributions are unreliable, as is acknowledged in the later historical literature. GRA

N80-32032# University of Southern California, Los Angeles. Systems Management Center.

DEVELOPMENT OF THE MICROWAVE RADIATIVE TRANSFER PROGRAM FOR CLOUDY ATMOSPHERES APPLICATIONS TO DMSP SSM/T CHANNELS Final Report, 1 Jun. 1978 - 30 Sep. 1979

Kuo-Nan Liou, Paul T. Nipko, Grant C. Aulder-Haar, and Hwa-Young Yeh 30 Dec. 1979 128 p refs

(Contract F19628-78-C-0144; AF Proj. 7670)

(AD-A087434; AFGL-TR-80-0051) Avail: NTIS HC A07/MF A01 CSCL 20/13

A microwave radiative transfer program for cloudy and precipitating atmospheres applicable to the DMSP SSM/T channels has been developed. The microwave transfer program takes into account the simultaneous contributions of multiple scattering and absorption by hydrometeors and absorption due to molecular oxygen and water vapor in the atmosphere. Sensitivity analyses have been carried out to investigate the effects of the rainfall rate, cloud thickness, and cloud location on the upwelling brightness temperature over land and ocean surfaces for two

different atmospheric profiles. Over the land surface, it is shown that increasing the cloud liquid water content and cloud thickness significantly reduces the brightness temperatures for SSM/T channels 1 - 3. Over the ocean surface, however, the brightness temperatures for channels 1 - 3 are increased as the cloud liquid water content increases and reach to maximum values depending on the cloud thickness involved. Moreover, we show the importance of the cloud position and the atmospheric temperature profile on the brightness temperature values. In addition, investigation of the effects of precipitation on the temperature retrieval using both the theoretically simulated values and real SSM/T data has also been carried out on the basis of a statistical method. The hypothetical retrieval experiments reveal that the temperatures close to the surface suffer increased degradation as the rainfall rate increases. This finding is further supported by the analysis employing the real SSM/T data for a number of case studies in which temperature profiles from radiosondes are available for comparisons. GRA

N80-32033# Naval Postgraduate School, Monterey, Calif. Environmental Physics Group.

ATMOSPHERIC MARINE BOUNDARY LAYER MIXING RATES IN THE CALIFORNIA COASTAL REGION

G. E. Schacher, K. L. Davidson, and C. W. Fairall May 1980 125 p refs Prepared in cooperation with BDM Corp., Monterey, Calif.

(AD-A087264; NPS61-80-003) Avail: NTIS HC A06/MF A01 CSCL 04/2

The Naval Postgraduate School has conducted five research cruises in California coastal waters for which sufficient data was obtained to allow boundary layer mixing rates to be determined. These data have been processed to determine the mixing rates. The rates have been correlated with meteorological conditions and geographical location and average values for use in air pollution models have been determined. A simplified method for calculating the mixing rate from mean meteorological parameters is presented. GRA

N80-32034*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

ON THE DYNAMIC FORCING OF SHORT-TERM CLIMATE FLUCTUATIONS BY FEEDBACK MECHANISMS

E. R. Reiter Sep. 1979 68 p refs

(Grant NaG-5340; Contract EY-76-S-02-1340; Grant NSF ATM-78-17835)

(NASA-CR-162865; COO-1340-66) Avail: NTIS HC A04/MF A01 CSCL 04B

Various internal feedback mechanisms in the ocean atmosphere system were studied. A variability pattern of sea surface temperature with a quasibiennial oscillation (QBO) was detected off the coast of Senegal, in the Gulf of Guinea and even in the Gulf Stream as it leaves the North American continental shelf. Possible physical connections between some of these QBO's were pointed out by a hypothetical feedback model. Interaction of a QBO with the annual cycle may lead to beating frequencies resembling climatic trends of a duration of several years. DOE

N80-32035# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.

INFLUENCE OF VOLCANIC AEROSOLS AND OCEANIC SURFACE TEMPERATURES ON TROPOSPHERIC TEMPERATURES

Alfredo R. Navato 1979 13 p refs Presented at the NOAA Climate Diagn. Workshop, Madison, Wisc., Oct. 1979

(Contract DE-AS02-76EV-12195)

(COO-2195-36) Avail: NTIS HC A02/MF A01

Results of a study to estimate the sensitivity of the tropical (20 deg N to 20 deg S) tropospheric temperatures to oceanic surface temperatures of the Pacific Ocean, Atlantic Ocean, and Indian Ocean, and to atmospheric dust and aerosol concentrations over the northern tropics and over the Southern Hemisphere are summarized. DOE

N80-32036# Fondazione Ugo Bordoni, Rome (Italy).

A STUDY ON ALGORITHMS AND PROCESSING PROGRAMS FOR DATA FROM INTERFERENCE DUE TO HYDROMETEORS AT 17.5 GHz [STUDI DEGLI ALGORITMI E DEI PROGRAMMI DI ELABORAZIONE DEI DATA DI INTERFERENZA DOVUTA A IDROMETEORE A 17.8 GHz]

Aldo Paraboni (Politecnico di Milan) Sep. 1979 47 p refs In ITALIAN

(FUB-12-1979) Avail: NTIS HC A03/MF A01

Rain interference studies related to a future Sirio satellite experiment are presented. The physical characteristics of the parameters to be measured are examined. The measuring system characteristics are related to the experiment objectives. The data processing techniques to assure optimal use of existing infrastructure are discussed. Author (ESA)

N80-32037# Fondazione Ugo Bordoni, Rome (Italy).

CHARACTERIZATION AND INFLUENCE OF THE PARAMETERS OF A MODEL TO DESCRIBE HYDROMETEOR DIFFUSION [INDIVIDUAZIONE ED INFLUENZA DEI PARAMETRI DI UN MODELLO ATTO A CARATTERIZZARE I FENOMI DI DIFFUSIONE DA IDROMETEORE]

Aldo Paraboni (Politec. di Milan) Sep. 1979 32 p refs In ITALIAN

(FUB-23-1979) Avail: NTIS HC A03/MF A01

A structural model of hydrometeor electromagnetic radiation diffusion is presented referred to centimeter and millimeter wavelengths and to satellite-ground transmissions. Two approaches to the probalistic prevision of scattering coupling, one taking into consideration the Misme-Fimbel storm cell model, and the other considering a stratified structure only, are discussed. Author (ESA)

N80-32038# Royal Netherlands Meteorological Inst., De Bilt. Statistisch Bureau.

RESULTS OF COMPARATIVE MEASUREMENTS WITH VARIOUS TYPES OF PLUVIOMETERS DURING THE PERIOD OF DECEMBER 1971 TO JANUARY 1975 AT DE BILT, NETHERLANDS [RESULTATEN VAN VERGELIJKENDE METINGEN MET DIVERSE TYPEN REGENMETERS IN HET TIJDVAK DECEMBER 1971 - JANUARI 1975 TE DE BILT]

A. Denkema 1980 6 p refs In DUTCH

(KNMI-V-342) Avail: NTIS HC A02/MF A01

Precipitation amounts and averages are given for ten different types of raingage installed at the same site. A national raingage for the Netherlands with a 200 cm sq opening was among the instruments used. The placement of the instruments relative to each other is shown. Author (ESA)

N80-32039# Royal Netherlands Meteorological Inst., De Bilt. Wetenschappelijk Onderzoek.

CLIMATOLOGY IN THE NETHERLANDS. ABSTRACTS OF SEVEN LECTURES GIVEN ON CLIMATE DAY [KLIMAATONDERZOEK IN NEDERLAND. SAMENVATTINGEN VAN EEN 7-TAL LEZINGEN GEHOUDEN OP DE 'KLIMAATDAG' 30 JANUARI 1980 TE DE BILT]

1980 46 p refs In DUTCH Lectures presented at De Bilt, Netherlands, 30 Jan. 1980

(KNMI-V-345) Avail: NTIS HC A03/MF A01

Climatology is studied with emphasis on climate change and modeling. Topics include use of fossil pollens in climate study, pollen research in Greece, modeling of ice caps, climate research using archival material, dendroclimatology and isotopes. Author (ESA)

N80-32040# Royal Netherlands Meteorological Inst., De Bilt. Fysisch Meteorologisch Onderzoek.

THE OCCURENCE OF A NOCTURNAL WIND MAXIMUM AT LOW ALTITUDE [HET OPTREDEN VAN EEN NACHTELIJK WINDMAXIMUM OP LAGE HOOGTE]

A. G. M. Driedonks 1980 28 p refs In DUTCH Presented at Colloq., De Bilt, Netherlands, Nov. 1979

(KNMI-V-346) Avail: NTIS HC A03/MF A01

A model is used to explain wind variation above the nocturnal boundary layer. Observations from Cabauw, the Netherlands are presented. It is shown that the maximum wind phenomenon may have a large horizontal spread. The circumstances favorable for the occurence of nocturnal wind maxima are shown. Author (ESA)

N80-32041# Royal Netherlands Meteorological Inst., De Bilt. Wetenschappelijk Onderzoek.

ANTHROPOGENIC CLIMATE CHANGES. STATE-OF-THE-ART SURVEY [ANTROPOGENE KLIMAATSVERANDERINGEN. OVERZICHT VAN DE STAND VAN ZAKEN]

J. Reiff, ed. and C. J. E. Schuurmans, ed. 1980 58 p refs Partly in DUTCH and ENGLISH

(KNMI-V-347) Avail: NTIS HC A04/MF A01

Climate change on both a global regional scale is discussed. The consequences of increased levels of freon, aerosols, CO2, and heating are examined as well as the effects of deforestation of tropical regions, increased desertification, and creation of artificial lakes. Urban climate and precipitation downwind from industrial zones are included. Author (ESA)

N80-32042# World Meteorological Organization, Geneva (Switzerland).

CONVERSION OF GRID-POINT DATA INTO METEOROLOGICAL MAPS WITH A MINI-COMPUTER SYSTEM

D. Soederman and L. Winberg 1980 47 p refs

(WMO-553; WWW-PLR-37; ISBN-92-63-10553-7) Avail: NTIS HC A03/MF A01; WMO, Geneva SWFR 5

The hardware and software required for installing and operating a grid-to-map conversion system at a regional or national meteorological center are described. General information is given on system configurations to be used for the conversion, including a mini-computer and plotter, or a direct computer-to-facsimile system. The software systems required to decode and generate maps from data encoded in the World Meteorological Organization GRID/GRAF codes are discussed and the graphical conversion system in operation at the Finnish Meteorological Institute is described. Author (ESA)

N80-32043# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

ENVIRONMENTAL WIND IN BUILT-UP AREAS

D. Olivari Feb. 1980 46 p refs Presented at Symp. on Recente Evolutie in de Hoogbouw, Leuven, Belgium, 28-29 Mar. 1979

(VKI-TM-26) Avail: NTIS HC A03/MF A01

The interaction between man-made structures and surface wind was studied. The structure of atmospheric winds and the effects of wind on human comfort are reviewed and the wind flow through built up areas is examined. The experimental techniques used and results obtained are discussed. It is shown that many observed effects are not clearly understood and that the only tool available for the prediction of the wind condition at the pedestrian level for new building developments is the wind tunnel. Author (ESA)

N80-32044# National Bureau of Standards, Washington, D.C. National Engineering Lab.

HURRICANE WIND SPEEDS IN THE UNITED STATES Final Report

Martin E. Batts, Martin R. Cordes, Larry R. Russell, James R. Shaver, and Emil Simin May 1980 54 p refs Sponsored in part by DOE Prepared in cooperation with Russell (Larry R.) and Associates, Inc.

(Grant NSF ENV-77-16113)

(PB80-181126; NBS-BSS-124; LC-80-600039) Avail: NTIS HC A04/MF A01 CSCL 04B

A Monte Carlo simulation technique is used to obtain estimates of hurricane wind speeds in the Gulf of East Coasts of the United States. The sources of data, the probabilistic models for the climatological characteristics of horricanes, and the physical models to the hurricane wind speed field used in the estimation are described. GRA

N80-32045# Water and Power Resources Service, Denver, Colo. Office of Atmospheric Resources Management.

USERS GUIDE FOR THE ANALYSIS AND INTERPRETATION OF SATELLITE IMAGERY ON THE HIGH PLAINS SUMMER CLOUD AND MESOSCALE SYSTEMS

David A. Matthews Jan. 1980 47 p refs

(PB80-175987) Avail: NTIS HC A03/MF A01 CSCL 04B

A guide to the analysis and interpretation of clouds and mesosynoptic systems observed in geosynchronous satellite imagery over the High Plains and Rocky Mountain region of the United States is presented. This guide provides examples of typical cloud types and mesoscale and synoptic scale systems. Methods used in the identification of these different phenomena are described to show the user how to interpret the information available on visible satellite imagery. Summertime convective and stratiform cases are analyzed with numerous examples of different cloud and cloud system structures. GRA

N80-32046# National Weather Service, Silver Spring, Md. Office of Hydrology.

COMPARISON OF GENERALIZED ESTIMATES OF PROBABLE MAXIMUM PRECIPITATION WITH GREATEST OBSERVED RAINFALLS

John T. Riedel and Louis C. Schreiner Mar. 1980 75 p refs

(PB80-191463; NOAA-TR-NWS-25; NOAA-B0050601) Avail: NTIS HC A04/MF A01 CSCL 04B

Known storms of record over the United States east of the 105th meridian and west of the Continental Divide that have point or areal rainfall depths that are = 50 percent of PMP are summarized. More than 240 storms met this criteria. The storms are identified and percentages of PMP are shown on maps. Some judgement on the relative magnitude of PMP in the two large regions is given by comparison of the ratios of PMP to 100 year return period rainfall. Such ratios for 24 hours range from 4 to 6 east of the 105th meridian. For the western mountainous states, these ratios are as low as 2 in the more mountainous locations and as high as 6 in the desert and sheltered spots. GRA

N80-32047# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

DOPPLER RADAR STUDIES DURING THE SIERRA COOPERATIVE PILOT PROJECT

W. R. Moninger Jan. 1980 110 p refs

(PB80-191455; NOAA-TM-ERL-WPL-50; NOAA-B0050711) Avail: NTIS HC A06/MF A01 CSCL 04B

Two case studies of frontal winter storms revealed a low level high speed jet moving toward the NNW, parallel to the foothills, was present ahead of both fronts; and both storms were highly complex, having a substructure of up and downdrafts oriented nearly perpendicular to the frontal surface. These storms differed in significant ways from typical high plains storms: (1) the strongest updrafts and greatest condensation rates occur in the lowest 1 to 2 km above cloud base, and (2) updrafts correspond generally to regions of high radar reflectivity factor, downdrafts to low reflectivity. GRA

N80-32048# Environmental Data and Information Service, Washington, D. C.

MARINERS WEATHER LOG, VOLUME 24, NO. 2

Elwyn E. Wilson, ed. Mar. 1980 86 p refs

(PB80-188444; NOAA-B0050102; ISSN-0025-3367) Avail: NTIS HC A05/MF A01 CSCL 04B

Estimation of surface pressures from satellite cloud patterns; North Atlantic tropical cyclones, 1979; and Great Lakes Weather Map Service plus Special Great Lakes Marine Storm Report for lakes mariners. GRA

N80-32049# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.

NATIONAL HURRICANE AND EXPERIMENTAL METEOROLOGY LABORATORY COLLECTED REPRINTS, 1979

Mar. 1980 127 p refs

(PB80-192917; NOAA-B0050702) Avail: NTIS HC A07/MF A01 CSCL 04B

Hurricanes, tropical cumulus convection and the atmospheric environments in which they occur and with which they interact are described. Mathematical models through high speed, large capacity computers are developed. These models simulate the development, structure, and behavior of hurricanes and other mesoscale events in their natural state and when experimentally modified. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-32050*# Texas A&M Univ., College Station.

ALTIMETRY DATA OVER TRENCHES AND ISLAND-ARCS

AND CONVECTION IN THE MANTLE Final Report, 1 Nov. 1979 - 31 Aug. 1980
18 Sep. 1980 26 p refs
(Contracts NCC5-11; NAGS-94)
(NASA-CR-163516) Avail: NTIS HC A03/MF A01 CSCL 08C

Transfer function techniques were developed to calculate the isostatic component of the geoid signal over trench/island arc/back arc systems. Removal of this isostatic component from geoid profiles determined by GEOS 3 radar altimetry leaves a residual geoid that can be attributed to the effect of mass inhomogeneities below the depth of compensation. Efforts are underway to extend the analysis to all the major trench/island arc systems of the world in order to provide more detailed understanding of the dynamic processes occurring beneath island arcs. A.R.H.

N80-32051*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE SEASAT SAR WIND AND OCEAN WAVE MONITORING CAPABILITIES: A CASE STUDY FOR PASS 1339M
Robert C. Beal Jan. 1980 66 p refs Revised Sponsored in part by NASA
(Contract MO-A01-78-00-4330)
(NASA-CR-163454; NOAA-80050104; PB80-194996; JHU/APL/SIR-79U-019) Avail: NTIS HC A04/MF A01 CSCL 08C

A well organized low energy 11 sec. swell system off the East Coast of the U.S. was detected with the Seasat Synthetic Aperture Radar and successfully tracked from deep water, across the continental shelf, and into shallow water. In addition, a less organized 7 sec. system was tentatively identified in the imagery. Both systems were independently confirmed with simultaneous wave spectral measurements from a research pier, aircraft laser profilometer data, and Fleet Numerical Spectral Ocean Wave Models. GRA

N80-32052# Environmental Research Inst. of Michigan, Ann Arbor.
SEASAT SAR COASTAL OCEAN WAVE ANALYSIS. A WAVE REFRACTION AND DIFFRACTION STUDY Final Report, Aug. 1978 - Nov. 1979
R. A. Shuchman, E. S. Kasischke, A. Klooster, and P. L. Jackson Nov. 1979 117 p refs
(Contract MO-A01-78-00-4339)
(PB80-189384; ERIM-138600-2F; NOAA-80050103) Avail: NTIS HC A06/MF A01 CSCL 08C

Analysis techniques used to exploit Seasat synthetic aperture radar (SAR) data are discussed and the Seasat SAR's capability to image gravity waves in coastal waters is evaluated. Synthetic aperture radar analysis techniques investigated were the effects of gravity wave motion on Seasat SAR focusing, geometric rectification of SAR data, use of optical Fourier transforms to obtain dominant wavelength and direction information from SAR data, and the use of digital techniques to exploit SAR data. Refraction of gravity waves in coastal waters was clearly evident, and a wave refraction model was used to predict water depths using inputs from the Seasat SAR data. GRA

N80-32053# Brookhaven National Lab., Upton, N. Y.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 65: SEDIMENT DATA FROM SHORT CORES DURING JOINT 2 OFF PERU Data Report
Gilbert T. Rowe Oct. 1979 57 p refs
(PB80-183155; NSF/IDOE-CUEA-DR-65; NSF/IDOE-80-11) Avail: NTIS HC A04/MF A01 CSCL 08G

Data obtained from cored sediments collected during the JOINT 2 CUEA experiment off Peru are presented. The cores were obtained with gravity cores or by subsampling a vanVeen grab. The 6 centimeter diameter cores range in length from 9 to 63 centimeters. Analyses conducted on sediment material include organic carbon, organic nitrogen, percent calcium carbonate and pore water concentrations of ammonia, nitrite, nitrate, silicate and phosphate. These data were collected in an attempt to gain knowledge of the interrelationships between early diagenesis and remineralization of organic matter, bioturbation, and dissolved ion exchange between the sediments and the overlying water. GRA

N80-32054# New Hampshire Univ., Durham. Dept. of Earth Sciences.
A STUDY OF ESTUARINE TIDAL DISSIPATION AND BOTTOM STRESS
Richard P. Trask and Wendell S. Brown Feb. 1980 74 p refs Sponsored by NOAA
(PB80-194988; UNH-SG-166; NOAA-80050713) Avail: NTIS HC A04/MF A01 CSCL 08C

Estimates of bottom stress in a tidal estuary are made by two independent means. Net energy budget calculations provided estimates of rates of tidal energy dissipation which can be interpreted in terms of an area averaged bottom stress (energy dissipation method). A second independent estimate of an area averaged bottom stress was made using the long wave momentum and continuity equations and estimates of sea surface slope and current acceleration (dynamic inference method). Preliminary energy budget calculations made for the Great Bay Estuary, New Hampshire, showed that a two km section of the estuary exhibits anomalously large tidal energy dissipation which was assumed to be due to bottom friction. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-32055*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES IN GAS EXCHANGE, TISSUE RESPIRATION AND GLYCOLYSIS IN RATS DURING HYPOKINESIA
L. V. Zorya May 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 22, no. 3, 1976 p 414-417 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76149) Avail: NTIS HC A02/MF A01 CSCL 06C

The results of an experiment which studied changes in oxygen balance under conditions of hypokinesia in rats is presented. The effect of the stress during hypokinesia is expressed most clearly in the changes of general gas exchange, and in the intensity of liver and myocardial tissue respiration. L.F.M.

N80-32056*# National Aeronautics and Space Administration, Washington, D. C.
THE INFLUENCE OF MODULATED SINUSOIDAL CURRENT ON THE STATE OF CHROMATIN FROM NEURONS OF THE CEREBRAL CORTEX OF RATS IN HYPOKINESIA
Z. A. Sokolova May 1980 10 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech. Fiz. Kul't (USSR), no. 1, Jan. - Feb. 1978 p 56-59 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76160) Avail: NTIS HC A02/MF A01 CSCL 06C

The biochemical changes under the influence of modulated sinusoidal current in the central nervous system were investigated. The methodology used is discussed, the results are reported in a table, and conclusions are presented. R.K.G.

N80-32057*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SINUSOIDAL MODULATED CURRENTS AND ACUTE HYPOXIA ON CORTICOSTERONE CONTENT AND ACTIVITY OF CERTAIN DEHYDROGENASES IN TISSUES OF DIFFERENT RAT ORGANS DURING HYPOKINESIA
L. L. Melik-Aslanova and I. D. Frenkel May 1980 12 p refs Transl. into ENGLISH from Vod. Kurortol., Fizioter. Lech. Fiz. Kulit. (USSR), no. 1, Jan. - Feb. 1978 p 59-65 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Central Inst. of Health Resort Treatment and Physical Therapy, Moscow
(Contract NASw-3198)
(NASA-TM-76161) Avail: NTIS HC A02/MF A01 CSCL 06C

The state of hypokinesia in rats was reproduced by keeping them for 30 days in special box cages that restricted their mobility in all directions. Results show the resistance to acute hypoxic hypoxia is increased. This is linked to the considerable rise in the reduced level of corticosterone in different organs and the succinate dehydrogenase activity in the liver and brain. The letter indicated the primary oxidation of succinate, which has great importance in the adaptation of the oxidative metabolism to acute oxygen insufficiency. The use of sinusoidal modulated currents in the period of hypokinesia promotes normalization of the indices for resistance of the rats to acute hypoxia. L.F.M.

N80-32058*# National Aeronautics and Space Administration, Washington, D. C.
THE DYNAMICS OF CERTAIN INDICATORS OF NUCLEIN METABOLISM DURING HYPOKINESIA IN RATS OF DIFFERENT AGES UNDER THE INFLUENCE OF SINUSOIDAL MODULATED CURRENTS AND MEASURED PHYSICAL LOAD
Z. A. Sokolova May 1980 9 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech. Fiz. Kulit. (USSR), no. 5, Sep.-Oct. 1977 p 67-70 Transl. by Scientific Translation Service, prepared by Central Inst. of Health Resort Treatment and Physiology, Moscow
(Contract NASw-3198)
(NASA-TM-76162) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of sinusoidal modulated currents was studied and physical loads on the nucleic acid content and the nucleotide composition of the total RNA in muscles of rats of various ages under conditions of hypodynamia were measured. Methodology utilized is described and conclusions are presented. R.K.G.

N80-32059*# National Aeronautics and Space Administration, Washington, D. C.
ABSORPTION OF THIAMINE AND NICOTINIC ACID IN THE RAT INTESTINE DURING FASTING AND IMMOBILIZATION STRESS
O. G. Kirilyuk and Yu. V. Khmelevskiy Jun. 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 23, no. 1, 1977 p 98-102 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Medical Inst., Kiev
(Contract NASw-3199)
(NASA-TM-76193) Avail: NTIS HC A02/MF A01 CSCL 06C

By perfusion of isolated sections of intestine with a solution containing thiamine at a concentration of 3.1 micromole, it was established that thiamine absorption in animals fasted for 72 hours decreased by 28 percent, whereas absorption increased by 12 percent in rats after 24 hour immobilization. After immobilization, absorption of label in the intestinal mucosa increased. Na K ATPase activity in the intestinal mucosa decreased by 10 percent during fasting, and it increased with immobilization of the animals. Activity of Na K ATPase in the intestinal mucosa cells determined the absorption rate of thiamine and nicotinic acid at the level of vitamin transport through the plasma membranes of the enterocytes. R.K.G.

N80-32060*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF FACTORS OF PROLONGED SPACE FLIGHT ON CONDITIONS OF TORTOISE SKELETON
G. P. Stupakon, A. I. Volozhin, V. A. Korzhenyants, V. S. Yagodovskiy, A. N. Polyakov, V. V. Korolev, and V. A. Elivanov Aug. 1980 13 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, Nov. - Dec. 1979 p 9-14 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76352) Avail: NTIS HC A02/MF A01 CSCL 06C

After a 60-90 day space flight mild osteoporosis developed in the epiphyses and metaphyses of long tubular bones of tortoises, which was not attributed to reduced mineral saturation of the preserved bone tissue microstructures. The diminished strength of the cancellous bone of the epiphyses in tortoises after space flight was due to the reduced properties of its structure. The strength of the compact substance did not change under the effect of weightlessness. R.C.T.

N80-32061# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
[HEALTH AND ENVIRONMENTAL RESEARCH RELATED TO ENERGY DEVELOPMENT AND USE] Annual Progress Report, 1 Jul. 1978 - 30 Jun. 1979
Jun. 1979 160 p
(Contract EY-76-C-03-0012)
(UCLA-12-1217) Avail: NTIS HC A08/MF A01

Highlights of research for FY-1979 is reported in the areas of biomolecular and cellular science, environmental biology of desert ecosystems and nuclear medicine. Abstracts of 156 published reports are included. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-32062* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 209)
Aug. 1980 57 p
(NASA-SP-7011(209)) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240; HC $7.00 CSCL 06E

This bibliography lists 169 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1980. Author

N80-32063# Illinois Univ. at Urbana-Champaign. Dept. of Psychology.
GROUND-REFERENCED VISUAL ORIENTATION WITH IMAGING DISPLAYS Final Scientific Report, Oct. 1977 - Sep. 1979
Stanley N. Roscoe Nov. 1979 47 p
(Contract F49620-77-C-0117)
(AD-A081882; ENG-PSY-79-4/AFOSR-79-4) Avail: NTIS HC A03/MF A01

Problems related to the accurate judgment of size and distance as required of pilots in flight were investigated over a two year period. The experiments covered a broad spectrum of psychophysiological issues involving the measurement of visual accommodation and its correlation with various other dependent variables. The latter included a short term memory task, physiological measures of autonomic balance, scores on a personality test of introversion extraversion, and responses to a personal inventory questionnaire. Psychophysiological issues investigated included the size distance invariance hypothesis, the moon illusion, night and empty field myopia, the dark focus and its so called Mandelbaum effect, the nature of the locus of the accommodative stimulus, and possible relationships among accommodative responses, autonomic balance, and personality. A.R.H.

N80-32064*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES IN BONE TISSUE UNDER CONDITIONS OF HYPOKINESIA AND IN CONNECTION WITH AGE
E. P. Podrushnyak and E. I. Suslov Jun. 1980 7 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 19, no. 6, Nov. - Dec. 1973 p 841-943 Transl. was announced as N80-21971 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76154) Avail: NTIS HC A02/MF A01 CSCL 06P

X-ray micrography was used to study the optical density of the blackening of X-ray photographs made of five bones in 9 young people (ages 24 to 29) before and after strict bed rest for 16 to 37 days. Photometric studies of the X-ray film determined the relative concentration of bone structure before and after hypokinesia. In addition, the bone tissues of 25 cadavers of practically healthy individuals (aged 18 to 70) who died from injuries were investigated using X-ray structural analysis. Results show that the reaction to the state of hypokinesia is not uniform in different individuals and is quite often directly reversed. It

was established that pronounced osteoporosis can be found in a relatively short time after conditions of hypokinesia in healthy young individuals. Results show that the stabilization of the crystalline structure of hydroxyapatite, especially its crystal formation, is finished by the age of 20 to 25. From 25 to 60, the crystal lattice remains in stable condition but X-ray analysis shows a reduction in the hydroxyapatite density. A.R.H.

N80-32065*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF HIRUDIN-INDUCED ACTIVATION OF NON-ENZYMATIC FIBRINOLYSIS DURING IMMOBILIZATION STRESS

F. B. Shapiro, I. P. Baskova, L. U. Cherkesova, L. A. Lyapina, and M. D. Goldovskaya Jul. 1980 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 64, no. 11, Nov. 1978 p 1567-1574 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Moscow State Univ.
(Contract NASw-3199)
(NASA-TM-76188) Avail: NTIS HC A02/MF A01 CSCL 06S

The specific inhibitor of thrombin, hirudin, was used for studying the mechanism of the activating effect of ACTH and adrenalin on nonenzymatic fibrinolytic activity (NEFA), the latter characterizing the function of the anticoagulation system (ACS). Simultaneous administration of ACTH and hirudin to animals subjected to immobilization stress did not reduce the effect of ACTH on NEFA, while simultaneous administration of adrenalin and hirudin revealed a diminished effect of the former. This suggests different mechanisms of ACTH and adrenalin effects upon NEFA: the stimulating effect of norepinephrine is realized through throminogenesis followed by activation of the ACS function and by increased NEFA and therefore inhibitable by hirudin which forms an inactive complex with thrombin. In fact the stimulating effect of ACTH upon NEFA is brought about specifically by another route than thrombinogenesis and thus occurs in the presence of hirudin. Hirudin itself has no effect upon NEFA. Author

N80-32066*# National Aeronautics and Space Administration, Washington, D. C.

RESTORATION OF PHYSICAL PERFORMANCE CAPACITY OF ATHLETES AFTER PROLONGED RESTRICTION OF THEIR MOTOR ACTIVITY

A. D. Soldatov and V. I. Finogeyev Aug. 1980 12 p Transl. into ENGLISH from Teor. Prakt. Fiziol. Kult. (USSR), no. 5, May 1979 p 19-22 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by All-Union Scientific Research Inst. of Physical Culture
(Contract NASw-3198)
(NASA-TM-76305) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of different regimens of treatment following prolonged hypokinesia were studied in order to determine the most effective program. The types of programs considered were passive means, consisting of physical therapy; active means, consisting of athletic training; and a combined program. In the first stage of the experiment, the effects of a 10 day period of hypokinesia were studied. It was determined that the restoration programs must address the problems of: (1) increasing defense function and general tone of the body; (2) restore orthostatic stability; and (3) increase general endurance. In later stages, groups of athletes and nonathletes underwent 30 day periods of hypokinesia. Restoration was carefully monitored for groups treated with the various regimens. It was determined that the most effective treatment was a comprehensive program of passive and active therapy. Author

N80-32067*# National Aeronautics and Space Administration, Washington, D. C.

PHYSICAL EXERCISES ON A BICYCLE-ERGOMETER AND RUNNING TRACK TO PREVENT HYPODYNAMIA IN WORKERS OF INTELLECTUAL LABOR

V. V. Vasilyeva, Ye. N. Korableva, and V. V. Trunin Aug. 1980 7 p refs Transl. into ENGLISH from Teor. Prakt. Fiziol. Kult. (USSR), no. 10, Oct. 1979 p 34-36 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by P. F. Lesgaft State Order of Lenin and Order of the Red Banner Inst. of Physical Culture
(Contract NASw-3198)
(NASA-TM-76306) Avail: NTIS HC A02/MF A01 CSCL 06P

A program of exercises was developed and tested, consisting of a 12 minute session on a variable load bicycle ergometer and a 10-11 min. run with brief stretching and resting sessions between. Physical performance capacity was measured before, during, and after the period of the experiment and physical exams conducted. After a 4 month test period involving 30 men, aged 25-35, the program was found to be successful in increasing physical performance capacity. The PWC170 increased an average of 22 percent and maximum oxygen consumption 14 percent. Arterial pressure dropped (120/75 to 114/68), vital capacity of lungs increased by 6 percent, strength of respiratory muscles by 8.8 percent, duration of respiratory delay by 18 percent. Duration of cardiac cycles increased, stress index decreased. Cardiac contraction rate 2 minutes after work on the ergometer decreased from 118 to 102 bt/min. R.C.T.

N80-32068*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF HYPOKINESIA ON BLOOD MICROCIRCULATION

A. M. Chernukh, O. G. Gazenko, B. M. Fedorov, T. N. Krupina, P. N. Aleksandrov, D. I. Shagal, N. Ye. Ranferova, and T. N. Proskurina Aug. 1980 9 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 3, May - Jun. 1979 p 10-13 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76308) Avail: NTIS HC A02/MF A01 CSCL 06S

Blood microcirculation in the region of the scleral bulbar conjunctiva and the nail folds on the fingers and toes was studied in 18 practically healthy men during 182 day antiorthostatic hypokinesia and 30 day rehabilitation period. Marked changes in microcirculation in the sclera and feet and less evident changes on the hands was revealed. A complex of special prophylactic physical exercises had a distinctly favorable effect on circulation in the hands. Author

N80-32069*# National Aeronautics and Space Administration, Washington, D. C.

THERAPEUTIC GYMNASTICS IN COMPREHENSIVE TREATMENT OF PATIENTS WITH GENERALIZED MYASTHENIA

R. L. Kapelovich Aug. 1980 9 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech Fiz. Kul' T. (USSR), no. 5, Sep. - Oct. 1979 p 41-45 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by I. M. Sechenov First Moscow Medical Inst.
(Contract NASW-3198)
(NASA-TM-76312) Avail: NTIS HC A02/MF A01 CSCL 06E

The technique of therapeutic gymnastics was used for patients with myasthenia gravis to control the consequences of hypodynamia induced by the myasthenic process. It is concluded that during myasthenia, the severity of the disease is due to the affection of the cross striated musculature. The most life threatening are the disorders in respiration and swallowing, that can be intensified by forced stay in bed and immobility. It is also concluded that the use of therapeutic gymnastics in patients which myasthenia promotes efficient presurgical preparation, and in the post surgical period; prevention of pulmonary complications and normalization of respiration. Therapeutic gymnastics with regard to the severity and localization of the myasthenic disorders must be a component part of the presurgical preparation and postsurgical management of patients with generalized myasthenia. R.C.T.

N80-32070*# National Aeronautics and Space Administration, Washington, D. C.

ORTHOCLINOSTATIC TEST AS ONE OF THE METHODS FOR EVALUATING THE HUMAN FUNCTIONAL STATE

V. A. Doskin, L. D. Gissen, O. Z. Bomshteyn, E. N. Merkin, and S. B. Sarychev Aug. 1980 8 p refs Transl. into ENGLISH from Gig. Sanit. (USSR), no. 4, Apr. 1979 p 41-44 Transl. by

Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by All-Union Scientific Research Inst. of Physical Culture, Moscow
(Contract NASw-3198)
(NASA-TM-76321) Avail: NTIS HC A02/MF A01 CSCL 06P

The possible use of different methods to evaluate the autonomic regulation in hygienic studies were examined. The simplest and most objective tests were selected. It is shown that the use of the optimized standards not only makes it possible to detect earlier unfavorables shifts, but also permits a quantitative characterization of the degree of impairment in the state of the organism. Precise interpretation of the observed shifts is possible. Results indicate that the standards can serve as one of the criteria for evaluating the state and can be widely used in hygienic practice. R.C.T.

N80-32071*# National Aeronautics and Space Administration, Washington, D. C.
BLOOD FILLING AND FLOW IN LUNGS DURING CHANGE IN BODY POSITION IN SPACE
A. S. Pogodin and B. I. Mazhbich Aug. 1980 12 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 66, no. 4, Apr. 1980 p 555-561 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Academy of Medical Sciences, Siberia
(Contract NASw-3198)
(NASA-TM-76333) Avail: NTIS HC A02/MF A01 CSCL 06P

In the horizontal position (supine and lateral), in the upright position (head up and head down) and during change of the cat body position in space, quantitative responses of regional blood volume and blood flow in the lungs (ml/100 cu cm) revealed presence of the gradient in the gravitation direction. Blood volume and blood flow of different lung portions changed qualitatively and quantitatively in different ways. These changes occurred only in the direction producing the equality of regional hydrostatical and hemodynamic loads in the lungs at either horizontal level. Author

N80-32072*# National Aeronautics and Space Administration, Washington, D. C.
OCCUPATIONAL CHANGES IN THE ORGAN OF HEARING AND EQUILIBRIUM IN SAILORS AND FISHERMAN
R. P. Menyakin and V. I. Poperetskaya Aug. 1980 9 p refs Transl. into ENGLISH from Vestn. Otorino-laringol. (USSR), no. 1, Jan - Feb. 1980 p 39-42 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Vladivostok Medical Inst.
(Contract NASW-3198)
(NASA-TM-76335) Avail: NTIS HC A02/MF A01 CSCL 06P

Prophylactic examination in persons engaged in fishing industry and in sailors of ocean-going ships demonstrated occupational cochlear neuritis, resulting from the action of noise and vibration. Five hundred and fifty three sailors and fishermen working under conditions of noise were studied. A total of 233 persons 43.7% were found to be suffering from changes of the auditory analyzer typically resulting from the action of noise and vibration. The most pronounced changes of hearing were revealed in fishermen, in 44.8% of the persons examined, the percentage also being the highest among the engine room workers (63%). The incidence of cochlear neuritis in sailors of the ocean-going steamship line and in personnel of research ocean-going ships was almost equal (39.9-40%). These indices differed in the engine room workers (42-46%). Vestibular function was investigated by caloric and rotation tests with the use of electronystagmography. The data obtained point to diminution of the vestibular analyzer excitability with increase of the length of navigation service. R.C.T.

N80-32073*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN FEATURES OF THE COCHLEOVESTIBULAR SYNDROME IN THE RESIDUAL STAGE OF TRAUMATIC BRAIN DISEASE
M. I. Garshin and V. Ye. Volyanskiy Aug. 1980 12 p refs Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 2, Mar.-Apr. 1980 p 37-41 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Psychoneurological Clinic, Odessa
(Contract NASw-3198)
(NASA-TM-76337) Avail: NTIS HC A02/MF A01 CSCL 06E

Caloric and rotation tests were applied to the study of the vestibular analyser in 84 patients in the residual state of traumatic disease of the brain. Vestibular disturbances of different degree revealed in 79 patients were as a rule accomplished by cochlear derangement. In the majority of patients the vestibular syndrome was supratentorial with the involvement of the diencephal-hypothalmic, subcortical, and cortical levels of the brain. Vestibular dysfunction correlated with such factors as severity of the sustained craniocerebral traum, duration of the posttraumatic period, and, particularly, with the character of the residual neurological syndrome. In accordance with the latter, it is recommended that vestibular disturbances be treated in the residual period of closed craniocerebral injuries with due regard for the principal pathophysiological mechanisms of the underlying neurological syndrome. Author

N80-32074*# National Aeronautics and Space Administration, Washington, D. C.
DIAGNOSIS OF LATENT FORMS OF LABYRINTHINE AFFECTIONS
V. P. Vasilyeva Aug. 1980 10 p refs Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 3, May-Jun. 1980 p 22-27 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by I.M. Sechenov First Moscow Medical Inst.
(Contract NASw-3198)
(NASA-TM-76338) Avail: NTIS HC A02/MF A01 CSCL 06E

Features and significance of individual vestibular symptoms for the diagnosis of latent labyrinthitis and limited forms of labyrinthine affections offering considerable difficulties are discussed. Vestibular symptoms are indistinct. In case of the negative fistular symptom the greatest significance is acquired by the study of posture nystagmus according to the results of electronystagmograms, changes of tonic reactions and statics, as well as data of experimental vestibular tests. The necessity of evaluation of all the vestibular symptoms from the point of view of their vector characteristics and in a complex of evidence obtained by otoneurological examination of the patient is emphasized. Delicate topic and differential diagnosis of vestibular disturbances is of great importance and significance in the choice of the conservative or surgical method of treatment. Author

N80-32075*# National Aeronautics and Space Administration, Washington, D. C.
TECHNIQUE OF ELECTRICAL STIMULATION OF THE VESTIBULAR ANALYZER UNDER CLINICAL CONDITIONS
S. N. Khechinashvili, B. M. Zargaryan, and K. G. Karakozov Aug. 1980 8 p refs Transl. into ENGLISH from Vestn. Otorino-laringol. (USSR), no. 5, Sep. - Oct. 1978 p 74-77 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Tbilisi Inst. of Physician Advancement
(Contract NASw-3198)
(NASA-TM-76347) Avail: NTIS HC A02/MF A01 CSCL 06P

Vestibular reactions appear under the action of direct current (dc) on the labyrinth of man and animals. A decrease of the stimulation effect of dc on the extralabyrinthine nervous formations in the suggested method is achieved by the use of electric pulses with steep front and back parts, as well as by previous anesthetization of the skin in the electrode application area by means of novocain solution electrophoresis. For this purpose a pulse producer giving trapezoid pulses with smoothly changing fronts and duration was constructed. With the help of an interrupter it is possible to stop the current increase instantly, and stimulation is performed at the level of the pulse 'plateau'. To induce vestibular reactions under monopolar stimulation, it is necessary to apply the current twice as high as that with bipolar electrode position. The use of short pulses with steep front and back parts for electrode stimulation of the vestibular analyzer is considered to be inexpedient. Author

N80-32076*# National Aeronautics and Space Administration, Washington, D. C.
REVIEW OF BOOK ULTRASOUND IN OTORHINOLARYNGOLOGY
I. V. Soldatov Aug. 1980 8 p Transl. into ENGLISH from Zh. Ushnykh Nosovykh Gorlovykh Bolez. (USSR), no. 3, May - Jun. 1979 p 86-87 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Academy of Medical Sciences
(Contract NASw-3198)
(NASA-TM-76349) Avail: NTIS HC A02/MF A01 CSCL 06E

Ultrasonic therapy for certain diseases is discussed. Success is reported in the treatment of chronic tonsilitis, sinusitis, and Meniere's disease. L.F.M.

N80-32077*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSIOLOGICAL REACTIONS OF A PASSENGER TO TRANSPORTATION CONDITIONS
A. M. Lukshin and V. P. Novoselov Aug. 1980 8 p refs Transl. into ENGLISH from Gig. Sanit. (USSR), no. 9, Sep. 1979 p 84-85 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Ministry of Communication, Moscow
(Contract NASw-3198)
(NASA-TM-76350) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of transportation conditions on the performance capacity of a passenger were studied, in order to establish the time for his most rapid inclusion in production activity after the trip. It was concluded that the transportation conditions impair the functional condition of the passenger's organism. The restoration of the functional state to the initial level occurs mainly in the space of one day. It is shown that it is necessary to take into consideration the adaptation of the organism during transfer to another climate zone. R.C.T.

N80-32078*# National Aeronautics and Space Administration, Washington, D. C.
REVIEW OF BOOK VESTIBULAR CRISES
N. S. Blagoveshchenskaya Aug. 1980 5 p Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 1, Jan. - Feb. 1980 p 36-77 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76354) Avail: NTIS HC A02/MF A01 CSCL 06E

The etiology, pathogenesis, clinical practice, treatment and rehabilitation of patients with vestibular crises is discussed. Classifications for vestibular disorders are given. Information on the frequency of vestibular crises is given. T.M.

N80-32079*# National Aeronautics and Space Administration, Washington, D. C.
USE OF PHYSICAL CULTURE TO INCREASE RESISTANCE OF SAILORS TO MOTION SICKNESS
I. V. Salanin Aug. 1980 8 p refs Transl. into ENGLISH from Teor. Prakt. Fiz. Kult. (USSR), no. 11, Nov. 1979 p 35-37 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Moscow State Inst. of Physical Culture
(Contract NASw-3198)
(NASA-TM-76355) Avail: NTIS HC A02/MF A01 CSCL 06S

From 50% to 70% of sailors are exposed to motion sickness in storms. A program of physical exercises is described and tested for effectiveness in preventing this problem. In comparing the results of tests of susceptibility to motion sickness given to groups before and after a program of exercises and to a control group, it is found that physical education can strengthen the vestibulary apparatus and help prevent motion sickness. A.R.H.

N80-32080*# National Aeronautics and Space Administration, Washington, D. C.
VESTIBULAR REACTIONS IN PATIENTS DURING OCCLUSION FORM OF CHORIOEPENDYMITIS
E. A. Ladyzhenskaya and B. K. Arifdzhanov Aug. 1980 10 p Transl. into ENGLISH from Med. Zh. Uzb. (USSR), no. 11, Nov. 1979 p 16-19 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Order of the Red Banner of Labor Medical Inst., Tashkent
(Contract NASw-3198)
(NASA-TM-76356) Avail: NTIS HC A02/MF A01 CSCL 06P

A change in intracranial pressure during chorioependymitis is discussed. The inflammatory process in the choroid plexi and walls of the cerebral ventricles is described. The otoneurological method, not having any significant contraindications, can be employed repeatedly, guaranteeing control in dynamics over the course of the disease and effectiveness of treatment. T.M.

N80-32081# School of Aerospace Medicine, Brooks AFB, Tex.
USAFSAM MICROPROCESSOR AUDIOMETER: SYSTEM REFERENCE MANUAL Final Report, Aug. 1977 - Aug. 1979
Michael L. Tworek, Jay H. Schlag, Donald C. Gasaway, and Harrell C. Sutherland Apr. 1980 29 p refs
(AD-A087342; SAM-TR-80-8) Avail: NTIS HC A03/MF A01 CSCL 06/5

A microprocessor audiometer was designed and built by USAFSAM personnel to investigate new techniques in audiometry and hearing conservation. The system's primary function is to provide a flexible test bed for developing new audiogram algorithms and implementing hearing conservation decision criteria. Pertinent information regarding hardware and software implementation is provided. GRA

N80-32082# Dayton Univ., Ohio. School of Engineering.
ANALYSIS AND MEASUREMENT OF HELMETED AIRCREWMAN RESPONSE RESULTING FROM BIRDSTRIKE Final Report, 1 Mar. 1977 - 31 Mar. 1979
Norman S. Phillips Wright-Patterson AFB, Ohio AMRL Jan. 1980 234 p refs
(Contract F33615-77-C-0534; AF Proj. 7231)
(AD-A087737; UDR-TR-79-56; AMRL-TR-79-75) Avail: NTIS HC A11/MF A01 CSCL 06/5

The purpose of the research was to investigate and evaluate the birdstrike phenomena in terms of injury potential. Data collected during canopy testing indicated that significant deflection could occur and cause deformation into the space occupied by the helmeted aircrewman. The traveling wave and its interaction with the helmeted head created an unusual impact environment for which evaluation criteria did not exist. In order to generate new criteria it was necessary to utilize the Articulated Total Body Model (ATBM) and incorporate within the model characteristics of the canopy, the helmet and human head and neck system. With a configuration representative of the impact phenomena, the kinetic response of the system to selected impacts could be compared with biomechanical data to infer injury. The deformation characteristics of the canopy were established by analysis of F-16 film data collected during birdstrike tests. The data indicate that the canopy deformation depth is proportional to bird kinetic energy but that canopy deformation wave speed does not increase with bird speed. The helmet stiffness characteristics were established from available drop test data. Force displacement curves were idealized for incorporation into the ATBM. These, along with canopy compliance data, were used to construct the stiffness at the canopy helmet interference. GRA

N80-32083# Wright State Univ., Dayton, Ohio. Dept. of Psychology.
DETECTION OF MOVING TARGETS IN PERIPHERAL VISION Final Scientific Report, Jun. 1978 - Jul. 1979
Frank E. Ward Dec. 1979 26 p refs
(Grant AF-AFOSR-3647-78; AF Proj. 2313)
(AD-A082541; AFOSR-80-0211TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Human detection of a moving target is a function of target size and contrast and target velocity. Recent work in human psychophysics and animal electrophysiology has shown that visual information is processed in many channels, each specialized to detect a particular aspect of the visual stimulus. For example, the human visual system appears to contain channels sensitive to spatial frequency, or target size. It was also shown that different spatial frequencies are processed at different temporal rates,

suggesting that detection may depend upon an interaction of target size and velocity. E.D.K.

N80-32084# Missouri Univ., Columbia. John M. Dalton Research Center.
MECHANISMS OF OXYGEN TOXICITY AT THE CELLULAR LEVEL Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Olen R. Brown 30 Jul. 1980 35 p refs
(Contract N00014-76-C-0328)
(AD-A087831; TR-4) Avail: NTIS HC A03/MF A01 CSCL 06/1

Significant progress occurred in four areas: (1) Effect of hyperoxia on reverse glycolysis: We concluded that glucose protects Escherichia coli against hyperoxia better than other intermediates later in glycolysis and in the Krebs cycle but not because of a specific inhibition of reverse glycolysis. There was no significant impairment of the three enzymes of reverse glycolysis: fructose-1,6-diphosphatase, phosphoenolpyruvate synthase, or phosphoenolpyruvate carboxykinase. (2) Effect of hyperoxia on synthesis of RNA, DNA and pyridine nucleotide coenzymes: Evidence was obtained for direct inhibition of RNA synthesis in cells poisoned by hyperoxia, while protein synthesis was not directly affected. DNA synthesis is impaired but it is not proven whether this is direct or indirect. NAD and NADH were severly decreased in cells during poisoning by hyperoxia. This decrease was prevented by niacin, but not quinolinate which is consistent with poisoning of quinolinate phosphoribosyltransferase (QPT), as previously reported. PRPP does not protect against oxygen poisoning. PRPP synthetase is not affected by hyperoxia, but PRPP accumulates in oxygen poisoned cells which is in agreement with inhibition of QPT. (3) Relationship of thiamine to oxygen toxicity. GRA

N80-32085# Cornell Univ., Ithaca, N. Y.
MOLECULAR MECHANISMS OF THE EPITHELIAL TRANSPORT OF TOXIC METAL IONS, PARTICULARLY MERCURY, CADMIUM, LEAD, ARSENIC, ZINC, AND COPPER Progress Report, 1 Jan. - 31 Dec. 1979
R. H. Wasserman 1979 54 p refs
(Contract EY-76-S-02-2792)
(COO-2792-3) Avail: NTIS HC A04/MF A01

The mechanism of lead transport, and especially the particular similarities or dissimilarities between lead and calcium in this process were studied. The absorption of these metals was determined in 3 week old White Leghorn cockerels, raised on a commercial diet or on a specified diet, using in vivo ligated loop procedure. The dose administered into the loop contained 0.5 micron Ci Pb203 (and/or 0.1 micron Ci Ca47), and 0.01 mM lead acetate (and/or 1 mM CaCl2) in 0.5 ml 0.15 M NaCl, pH 6.5. It was shown that lead is rapidly taken up by the mucosal tissue, and slowly transferred into the body, whereas less calcium is retained by the tissue and the transfer of calcium is many times as effective as that for lead. They appear to respond in a similar manner to a low calcium intake and vitamin D treatment. Certain differences were, however, observed in the absorption process. Increasing luminal stable lead concentration from 0.01 to 1.00 mM Pb, significantly reduced the percentage of radiolead absorbed, but did not affect the absorption of calcium. Also, vitamin D enhanced the transfer of plasma Ca47 into the lumen but did not affect the transfer of plasma Pb203. R.C.T.

N80-32086# Royal Aircraft Establishment, Farnborough (England).
TOWARDS A BETTER UNDERSTANDING OF TEMPORARY THRESHOLD SHIFT OF HEARING
K. R. Maslen London HMSO Mar. 1980 50 p refs
(RAE-TM-FS-319; BR73973) Avail: NTIS HC A03/MF A01

It was thought that temporary threshold shift (TTS) of hearing due to exposure to noise might be more easily understood if the shifts were considered in terms of the rms pressure rather than in dB. The form is to be expected if the rate of shift of the pressure threshold were proportional to the difference between itself and the ultimate threshold were calculated and compared with a limited selection of published data. Good agreement with data for the growth of TTS in individuals was found, and moderately good agreement with recovery. Agreement with data on intermittent exposures was poor, but this may be due in part to the fact that only averaged data were found and averaging the widely disparate figures obtained for individuals may mask the true effects. It is also shown that the maximum ultimate TTS due to exposure to noise may be simply related to the mean square pressure of that noise. It is suggested that at least some facets of TTS can be simply described in terms of exponential pressure shifts. Author (ESA)

N80-32087# Bureau of Radiological Health, Rockville, Md.
PROCEEDINGS OF A WORKSHOP ON THERMAL PHYSIOLOGY
T. Whit Athey, ed. Mar. 1980 84 p refs Workshop held at Rockville, Md., 29 Mar. 1979 Sponsored by Interagency Regulatory Liaison Group
(PB80-187867; FDA/BRH-80/60; DHEW/PUB/FDA-80-8109) Avail: NTIS HC A05/MF A01 CSCL 06R

A consistent radiation protection philosophy for radio frequency and microwaves is developed. Radio frequency and microwave emitters and the populations exposed to significant sources are identified and classified. A biological and physical research program is developed. GRA

N80-32088# Professional Staff Association of the Rancho Los Amigos Hospital, Inc., Downey, Calif.
EFFECTS OF AEROSOLS, OXIDES OF NITROGEN, AND OXIDANTS ON HUMAN HEALTH Final Report
Michael T. Kleinman, William S. Linn, and Jack D. Hackney Dec. 1979 112 p refs Sponsored by Coordinating Research Council, Inc.
(PB80-184583; CRC-APRAC-CAPM-31-79) Avail: NTIS HC A06/MF A01 CSCL 06T

Volunteers in normal health and volunteers with asthma were exposed to polydisperse ammonium nitrate aerosol under conditions simulating 'worst-case' ambient exposures. Normal volunteers exposed to 0.37 ppm ozone plus 0.37 ppm sulfur oxide plus 100 micrograms/cu m polydisperse sulfuric acid aerosol under simulated ambient conditions showed small statistically significant decrements in forced expiratory function. Hemoglobin saturation was sampled repeatedly with a Hewlett-Packard ear oximeter during exposures of volunteers to ozone under simulated ambient conditions. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-32089# RAND Corp., Santa Monica, Calif.
THE INFLUENCE OF VISUAL-SPATIAL ABILITY AND STUDY PROCEDURES ON MAP LEARNING SKILL Progress Report, Jun. 1978 - Jan. 1979
Cathleen Stasz and Perry W. Thorndyke Jun. 1980 40 p refs
(Contract N00014-78-C-0042; NR Proj. 157-410)
(AD-A087247; RAND/N-1501-ONR) Avail: NTIS HC A03/MF A01 CSCL 05/10

This study investigated the influence of two sources of individual differences in knowledge acquisition from maps: abilities and learning procedures. Twenty-five subjects provided verbal protocols while attempting to learn two maps. Visual spatial ability was highly correlated with recall of spatial attributes of the map and with overall learning performance, while associative memory ability was most correlated with verbal attribute recall. Subject selected procedures for encoding spatial information and assessing learning progress also distinguished the behavior of successful and less successful learners. However, subjects of high and low ability differed little in the study procedures they chose. Although both ability differences and procedure use were important contributors to performance, a direct comparison of these sources of variation suggested that abilities are most predictive of map learning. These observations led us to the following conclusions: (1) the use of effective study procedures can influence map learning performance, and (2) high ability subjects benefit more from the use of these procedures than low ability subjects. GRA

N80-32090# Air Force Human Resources Lab., Brooks AFB, Tex. Operations Training Div.

AIRBORNE PERFORMANCE MEASUREMENT ASSESSMENT: LOW ALTITUDE TACTICAL FORMATION IN TWO OPERATING ENVIRONMENTS Interim Report, Jun. - Oct. 1978

Joseph C. Demasio and Edward E. Eddowes Jul. 1980 17 p refs

(AF Proj. 1123)

(AD-A087068; AFHRL-TR-79-44) Avail: NTIS HC A02/MF A01 CSCL 05/9

A method was developed to assess pilot performance in low altitude tactical formation (LATF) and to relate overall performance to performance on subtasks necessary to mission success. The method was used to evaluate the performance of 28 pilots assigned to an operational A-7 squadron. The method was found to provide a consistent measure of pilot performance and to reveal the importance of certain pilot skills to the LATF task. Performance ratings were obtained under routine operating conditions and under conditions of simulated combat. Differences were obtained in performance ratings under the two conditions. Implications for currency training were discussed. GRA

N80-32091# School of Aerospace Medicine, Brooks AFB, Tex.

A REVIEW OF USAFSAM STUDIES EMPLOYING MULTIPLE-TASKS PERFORMANCE DEVICES Final Report, Oct. - Dec. 1979

Bryce O. Hartman, Russell A. Benel, and William F. Storm Jun. 1980 21 p refs

(AD-A087272; SAM-TR-80-16) Avail: NTIS HC A02/MF A01 CSCL 05/10

Apparatus development at the USAF School of Aerospace Medicine to measure the performance and proficiency of systems operators is reviewed. The devices reviewed are all classified as multiple-task performance batteries that were designed to measure efficiency in the general sense. Simulators of specific systems were not included. The bulk of this paper consists of summaries of studies. GRA

N80-32092# Litton Mellonics Systems Development Div., Springfield, Va.

TEAM TRAINING APPLICATIONS OF VOICE PROCESSING TECHNOLOGY Final Technical Report, 1 Aug. 1979 - 31 Mar. 1980

Beverly A. Popelka and C. Mazie Knerr 31 Mar. 1980 36 p refs

(Contract MDA903-79-C-0209; ARPA Order 3690)

(AD-A085999) Avail: NTIS HC A03/MF A01 CSCL 05/9

Automated speech technology and intelligent computer assisted instruction offer unique solutions to problems of training teams in communication and coordination skills. At this point in the emergence of automated speech technology, scientists have only begun to explore its training uses. The application of automated speech technology entails adaptive training, or intelligent computer assisted instruction techniques in which the computer acts like a human tutor. This report reviews the goals and accomplishments of automated speech processing and its application to training, especially military team training. GRA

N80-32093# North Carolina Univ. at Chapel Hill. Psychometric Lab.

INDIVIDUAL DIFFERENCE RELATIONS IN PSYCHOMETRIC AND EXPERIMENTAL COGNITIVE TASKS Final Report

John B. Carroll Apr. 1980 335 p refs

(Contract N00014-77-C-0722; RR0420401; NR Proj. 150-406)

(AD-A086057; Rept-163) Avail: NTIS HC A15/MF A01 CSCL 05/10

A critical survey is made of recent literature pertaining to the possibility of measuring important dimensions of human cognitive ability through various types of simple cognitive tasks. The survey focuses on individual differences (IDs) found in cognitive tasks that have received extensive study in experimental cognitive psychology-for example, simple and choice reaction time, lexical decision, stimulus matching, probed search of short term memory, memory span, free and serial recall, simple sentence comprehension, and analogical reasoning. Questions of paramount interest were: What kinds of individual differences are observed in these tasks? Do they exhibit sufficient variance and reliability to measure stable individual characteristics that may be of relevance in personnel selection and other operational context? What are the dimensions of these IDs from a factor analytic standpoint? How are they related to those observed through more conventional psychometric tests? To what extent are they subject to the effects of practice and specific training, or related to demographic variables in such a way as to reduce their utility for operational use? Can the study of individual difference in simple cognitive tasks be valuable in the development of psychological theory: A considerable portion of the monograph is devoted to the definition and specification of 'elementary cognitive tasks' (ECTs) and to how ETCs can be administered, in experimental settings, so as optimally to reveal IDs in cognitive processes. A scheme for classifying ECTs according to basic paradigms is presented, and suggestions are made concerning procedures, including computer simulation, for conceptualizing and analyzing underlying processes. GRA

N80-32094# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

METHODS FOR COLLECTING AND ANALYZING TASK ANALYSIS DATA Final Report

A. John Eschenbrenner, Jr., Philip B. DeVries, Jr., James T. Miller, and Hendrick W. Ruck Jul. 1980 176 p refs

(Contract F33615-77-C-0076)

(AD-A087710; AFHRL-TR-79-45-1) Avail: NTIS HC A09/MF A01 CSCL 05/9

Task analysis, a critical front end activity in the Instructional System Development methodology, is the process of partitioning job tasks into their component subtasks and identifying the skills and knowledges required to support task performance. This study was initiated in response to a Request for Personnel Research generated by the Air Training Command, which noted that 'a wide range of nonstandardized task analysis procedures are in use throughout the training community.' Implementation of a standardized procedure for identifying essential subtasks and supporting skills and knowledges was expected to hold considerable potential for increasing training efficiency and reducing training costs. A simplified task analysis procedure and documentation system was specified, and a task analysis handbook was prepared. Handbook procedures were field tested at six Air Force installations. Results indicated that the handbook procedures met the design criteria of simplicity, validity, reliability, and time efficiency/cost effectiveness. The feasibility and utility of implementing a computer based task analysis data bank was assessed, and a preliminary data bank design was then developed. Additionally, two technology transfer seminars were conducted to assist Air Force personnel in applying handbook task analysis procedures. GRA

N80-32095# Virginia Polytechnic Inst. and State Univ., Blacksburg.

AIR-TO-AIR TARGET ACQUISITION FACTORS AND MEANS OF IMPROVEMENT Final Report, Nov. 1978 - Jul. 1979

Edward B. Costanza, Scott R. Stacey, and Harry L. Snyder Mar. 1980 241 p refs

(Contract F33615-78-D-0629; AF Proj. 2787)

(AD-A087848; VPI-HFL-79-10; SAM-TR-80-9) Avail: NTIS HC A11/MF A01 CSCL 06/16

This report summarizes the literature on target acquisition with emphasis on target detection and collision avoidance in the air-to-air environment. A comprehensive, annotated bibliography is included. Major factors in air-to-air acquisition are discussed, pertinent data are presented, and potential improvements through training are listed. The report is concluded with a description of a research program designed to improve air-to-air detection performance. GRA

N80-32096# Massachusetts Inst. of Tech., Cambridge. Man-Machine Systems Lab.

THE USE OF INFORMATION TRANSMISSION AS NONPARAMETRIC CORRELATION IN THE ANALYSIS OF COMPLEX BEHAVIOR: A PRELIMINARY REPORT Technical Report, 1 Jul. 1979 - 30 Jun. 1980

Neville Moray May 1980 120 p refs

(Contract N00014-77-C-0256)

(AD-A087832) Avail: NTIS HC A06/MF A01 CSCL 05/8

Recent developments of classical information theory by Conant and Ashby have given rise to a number of techniques by which the behavior of a complex system can be analyzed. Even in the absence of any information about the intensity of the variables measured it is possible to detect which parts of the system are closely coupled and which independent. The metrics of the variables can be mixed, nominal, ordinal, etc. and the method is particularly suited to dynamic systems. This paper discusses how the structure of the 'molecules' of behavior can be deduced from the entropies of the 'atoms', and outlines the solutions to certain methodological problems involved. Examples of the method are given from the fields of attention and skills, including the representation of the effects of practice on a 7-degree-of-freedom perceptual motor skill involving a complex man-machine interface. Further analysis and development of the technique is being carried out and will be reported subsequently. GRA

N80-32097# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

VISUAL SCENE PERCEPTION. FREQUENCY DOMAIN DATA AND MODEL PARAMETER ESTIMATION PROCEDURE

P. H. Wewerinke 15 Mar. 1979 24 p refs Presented at 15th Ann. Conf. on Manual Control, Dayton, Ohio, 20-22 Mar. 1979 Sponsored by Netherlands Agency for Aerospace Programs (NIVR)

(NLR-MP-79009-U) Avail: NTIS HC A02/MF A01

Results of a theoretical study and an accompanying experiment are presented concerning the visual scene perception process and its impact on aircraft approach performance. Visual scene characteristics were represented by the configurations involved. Their effect on approach performance and human information processing (primarily in terms of observation noise spectra and perceptual thresholds) was investigated utilizing a model of the visual scene perception process. The model is based on linear perspective geometrical cues and on relative (visual) motion cues and is combined with the optimal control model. Results are presented of an automated model matching procedure. Via a first order gradient method, a matching criterion (involving variances and frequency domain data) was minimized yielding a set of observation noise model parameter values. These values led to the perceptual thresholds associated with the visual cues involved. Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-32098*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.

PROJECT FIRES. VOLUME 1: PROGRAM OVERVIEW AND SUMMARY, PHASE 1B Final Report

Fred J. Abeles May 1980 49 p refs

(Contract NAS8-32329)

(NASA-CR-161529) Avail: NTIS HC A03/MF A01 CSCL 06Q

Overall performance requirements and evaluation methods for firefighters protective equipment were established and published as the Protective Ensemble Performance Standards (PEPS). Current firefighters protective equipment was tested and evaluated against the PEPS requirements, and the preliminary design of a prototype protective ensemble was performed. In phase 1B, the design of the prototype ensemble was finalized. Prototype ensembles were fabricated and then subjected to a series of qualification tests which were based upon the PEPS requirements. Engineering drawings and purchase specifications were prepared for the new protective ensemble. Author

N80-32099*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.

PROJECT FIRES. VOLUME 4: PROTOTYPE PROTECTIVE ENSEMBLE QUALIFICATION TEST REPORT, PHASE 1B Final Report

Fred J. Abeles May 1980 127 p refs

(Contract NAS8-32329)

(NASA-CR-161532) Avail: NTIS HC A07/MF A01 CSCL 06Q

The qualification testing of a prototype firefighter's protective ensemble is documented. Included are descriptions of the design requirements, the testing methods, and the test apparatus. The tests include measurements of individual subsystem characteristics in areas relating to both physical testing, such as heat, flame, impact penetration and human factors testing, such as dexterity, grip, and mobility. Also, measurements related to both physical and human factors testing of the complete ensemble, such as water protection, metabolic expenditures, and compatibility are considered. M.G.

N80-32100*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.

PROJECT FIRES. VOLUME 3: PROTECTIVE ENSEMBLE DESIGN AND PROCUREMENT SPECIFICATION, PHASE 1B Final Report

Fred J. Abeles May 1980 133 p

(Contract NAS8-32329)

(NASA-CR-161531) Avail: NTIS HC A07/MF A01 CSCL 06Q

Each of the subsystems comprising the protective ensemble for firefighters is described. These include: (1) the garment system which includes turnout gear, helmets, faceshields, coats, pants, gloves, and boots; (2) the self-contained breathing system; (3) the lighting system; and (4) the communication system. The design selection rationale is discussed and the drawings used to fabricate the prototype ensemble are provided. The specifications presented were developed using the requirements and test method of the protective ensemble standard. Approximate retail prices are listed. A.R.H.

N80-32101*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology, Research and Development Div.

DEVELOPMENT OF A PREPROTOTYPE VAPOR COMPRESSION DISTILLATION WATER RECOVERY SUBSYSTEM Final Report

K. L. Johnson Nov. 1978 289 p ref

(Contract NAS9-15136)

(NASA-CR-160779; LMSC-D826041) Avail: NTIS HC A13/MF A01 CSCL 06K

The activities involved in the design, development, and test of a preprototype vapor compression distillation water recovery subsystem are described. This subsystem, part of a larger regenerative life support evaluation system, is designed to recover usable water from urine, urinal rinse water, and concentrated shower and laundry brine collected from three space vehicle crewmen for a period of 180 days without resupply. Details of preliminary design and testing as well as component developments are included. Trade studies, considerations leading to concept selections, problems encountered, and test data are also presented. The rework of existing hardware, subsystem development including computer programs, assembly verification, and comprehensive baseline test results are discussed. Author

N80-32102# Mitre Corp., Bedford, Mass.

REQUIREMENTS DEFINITION AND DESIGN GUIDELINES FOR MAN-MACHINE INTERFACE IN C3 SYSTEM ACQUISITION

Sidney L. Smith Jun. 1980 120 p refs

(Contract F19628-80-C-0001; AF Proj. 572R)

(AD-A087258; M80-10; ESD-TR-80-122) Avail: NTIS HC A06/MF A01 CSCL 17/2

The man-machine interface (MMI) represents a significant proportion of the hardware and software investment in Air Force C3 system acquisition. Early definition of MMI requirements and provision of design guidance in functional specification may be critical to successful system development. Tentative design guidelines are proposed in this report for further elaboration, trial application and subsequent evaluation in collaboration with selected ESD/MITRE program engineering efforts. GRA

N80-32103# School of Aerospace Medicine, Brooks AFB, Tex.
MAN-RATING OF THE NAVY/AIR FORCE OXYGEN GENERATING SYSTEM (NAOGS) Interim Report, 1 Jan. 1978 - 30 Sep. 1979
Ronald D. Holden, Arnott A. Moore, Kenneth G. Ikels, and Richard L. Miller May 1980 15 p refs
(AF Proj. 1930)
(AD-A087270; SAM-TR-80-12) Avail: NTIS HC A02/MF A01 CSCL 01/3

The Navy/Air Force Oxygen Generating System (NAOGS) program is a joint effort between the Air Force and the Naval Air Development Center to develop a two man onboard oxygen generator for tactical aircraft. One of the proposed systems is based upon reversible sorption of oxygen from aircraft engine bleed air using fluomine, a cobalt chelate. The NAOGS fluomine system was manufactured by Garrett/AiResearch Division, Torrance, California. The USAF School of Aerospace Medicine performed man-rating of the NAOGS-fluomine unit prior to flight test by the U.S. Navy. The experimental protocol at USAFSAM consisted of both unmanned and manned testing, during which the product oxygen was monitored for quantity, purity, and trace contaminant content. Man-rating consisted of actual flight simulations with 2 test subjects at four different altitudes for periods up to 2 hours while breathing the product oxygen. The NAOGS, for the most part, performed adequately during both manned and unmanned testing. The exceptions were a lower than specification oxygen production rate and a short-term drop in oxygen purity during each bed switching cycle. These shortcomings are discussed in the context of the forthcoming flight test program. GRA

N80-32104# School of Aerospace Medicine, Brooks AFB, Tex.
THERMAL CONDITIONS IN THE COCKPIT OF USAF AIRCRAFT: INFLIGHT MEASUREMENTS FROM THE A-7, A-10, F-4, F-15, AND YC-14 Interim Report, Jun. 1977 - Dec. 1978
Richard F. Stribley Apr. 1980 71 p refs
(AD-A087273; SAM-TR-80-6) Avail: NTIS HC A04/MF A01 CSCL 01/3

Cockpit environmental data are presented for A-7, A-10, F-4, F-15, and YC-14 aircraft. Representative values for dry-bulb, dew-point, and black-globe temperatures; air velocity; and four additional air temperatures are presented for each flight. The data are summarized and the physiological implications of the recorded temperatures are discussed. A detailed description of the USAF School of Aerospace Medicine Miniature Environmental Monitor 2 (MEM 2) is provided. GRA

N80-32105# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
ADHESIVE COATINGS FOR DH-411 HELMETS
J. C. Lazowski Jan. 1980 18 p refs
(AD-A087319; DCIEM-TC-80-C-02) Avail: NTIS HC A02/MF A01 CSCL 06/17

Helicopter helmets in the Canadian Forces are required in two interchangeable roles, white and camouflaged. At present, helmets used by members of tactical helicopter squadrons are painted green to achieve the camouflage effect. Painting and stripping of helmets are time-consuming tasks which may deteriorate the impact protection of the helmet. Two adhesive coatings, olive drab gun tape and an adhesive vinyl coating in a disruptive pattern, were evaluated to determine the effect of extremes of temperature upon the coatings and the coated helmet shell. It was found that a marked discoloration of the helmet shell occurred during seven hour exposures to 200 F when coated with olive drab gun tape. It is concluded that the adhesive vinyl coating is superior to the gun tape on the basis of appearance and discoloration of the helmet shells. GRA

N80-32106# National Technical Information Service, Springfield, Va.
HELMETS: CONSTRUCTION, EFFECTIVENESS, AND HUMAN FACTORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Edith Kenton Jun. 1980 195 p
(PB80-810963) Avail: NTIS HC $30.00/MF $30.00 CSCL 06Q

A bibliography containing 188 abstracts is presented covering a variety of helmets including motorcyclist and bicyclist's helmets, industrial firefighters, mining, infantry and flightcrew's helmets, police and riot helmets, and swimmer's and diver's protective helmets. Topics cover areas such as the materials used in helmet construction, the development of design criteria, configuration, and components of helmets such as suspension systems, cooling, and goggles. A number of citations deal with performance tests and requirements, test methods, structural and dynamic testing, human factors evaluation, operational efficiency, speech intelligibility, and sound localization. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-32107 Polytechnic Inst. of New York.
DATA STRUCTURE INDEPENDENCE IN DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
E. James Emerson 1980 224 p
Avail: Univ. Microfilms Order No. 8019396

The system that is proposed to achieve data structure independence includes three schemas: conceptual, physical and logical. The role of the conceptual schema is to represent the enterprise's data in such a way that the integrity of the data base is assured and data structure independence is achieved. To accomplish this a relational model of data with extensions to provide for integrity assertions was selected for the conceptual schema. The conceptual schema serves as the base from which both the logical and physical schemes are derived, thereby completely isolating one from the other. The physical schema has many similarities to a CODASYL data base. It contains owner to member sets and permits them to be combined to form networks. Additionally, it contains extensions such as secondary indexes, and could be augmented with additional facilities in the future. The logical schema has a single syntax used to define logical views for a CODASYL, Relational or IMS data model. The logical schemas are dervied from the conceptual schema using four primitive mappings. It is demonstrated that these mappings are sufficient to generate the data structures required for the three models, and the structural mappings that are required to achieve data structure independence. Dissert. Abstr.

N80-32108 Polytechnic Inst. of New York.
MULTI-MICROPROCESSOR/MULTI-MICROCOMPUTER ARCHITECTURES: THEIR MODELING AND ANALYSIS Ph.D. Thesis
Dimitris A. Protopapas 1980 199 p
Avail: Univ. Microfilms Order No. 8019410

Conditions under which a finite source queue can be

approximated by an infinite source one are presented, and a mean-wait approximation technique is developed for the computationally involved M/G/1/N queueing system. An approximation method is also developed for the generalized finite source queue, GI/G/1/N. Expressions are derived for the LST, and the variance of M/G/1/N, when service distributions are nonanalytic. Application of the Mi/Mi/1/N queueing model, is introduced. Generic micro-models are developed for the common bus multi-microprocessor/multi-microcomputer architecture. Both symmetric and asymmetric models are analyzed using the results derived for finite queues. Models are developed for traffic sharing, symmetrical or load balancing, and functionally distributed organizations, which are then analyzed using the generalized queueing approximation techniques. Performance, cost, and other merits of these organizations are compared, and conclusions are drawn. Dissert. Abstr.

N80-32109 California Univ., Santa Barbara.
MICROCOMPUTERS AND TIMESHARING Ph.D. Thesis
William Langdon Proctor 1979 277 p
Avail: Univ. Microfilms Order No. 8019853

The ability of microprocessors to support the data manipulations required by timesharing with reentrant program execution is demonstrated by evaluation of an operational prototype. Response latency due to processor loading is analyzed theoretically and empirically for an application involving dispersal of textual data to a number of concurrent users. The application is a text dialog language known as Pilot. The question of economic viability is considered by comparing cost-effectiveness of microprocessor timesharing, dedicated microprocessing and mainframe timesharing. Several recent microprocessor architectures are comparatively evaluated in relation to programming requirements of timesharing with reentrant program execution. This results in a number of observations regarding the physical structures of a central processor which significantly affect compatibility with timesharing. A computer assisted design and optimization methodology is introduced providing a means for evaluation of hardware cost functions and programming efficiency for existing and tentative architectures in the context of specific applications.
Dissert. Abstr.

N80-32110# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
USAFSAM WAIVER FILE INTELLIGENT TERMINAL: HARDWARE REFERENCE MANUAL Final Report, Oct. 1978 - Jun. 1979
Michael L. Tworek, M. Edward Womble, and Shelburne D. Wilson Apr. 1980 24 p refs
(AF Proj. 7755)
(AD-A087340; SAM-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

The hardware design and configuration of an intelligent microcomputer terminal is described. This terminal is used to access a data base on a larger main frame computer. The system was designed to provide maximum flexibility at the users fingertips by making the complex data base management system (DBMS) of the main frame computer transparent to the user. All aspects of the system configuration are outlined to provide sufficient knowledge for maintenance and repair. GRA

N80-32111# Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.
PROGRAMS FOR DISTRIBUTED COMPUTING: THE CALENDAR APPLICATION
Irene Greif Jul. 1980 11 p refs
(Contract N00014-75-C-0661)
(AD-A087357; MIT/LCS/TM-168) Avail: NTIS HC A02/MF A01 CSCL 09/2

The calendar application involves a wide range of issues in distributed computing, from implementation of distributed data bases to design of a user interface that will enable the user to comprehend the complex distributed environment in which he is working. This memo summarizes current status of design and implementation of calendars. Sections 2 and 3 are taken from a progress report of March 1980 and section 4 is an update to that report including current status plans. We began our design of calendar systems with the intention of focussing on implementation issues, particularly those of communication, sharing of data, and the use of forms as the standard interface among modules. To assure variety in our implementation experience, we generated alternative designs of calendars. Implementations of several of them are now underway. During later design phases we became more interested in the functionality of the calendar and its user interface. To some extent the use of forms as the communication medium shapes the human interface as well as the process to process interface. Also, some aspects of the functionality, most notably the notion of (tentative meeting) have arisen from analysis of the distributed implementation. Section 2 is a report on the functionality of the calendars we are building. Section 3 is about the distributed implementation. GRA

N80-32112# Doty Associates, Rockville, Md.
HANDBOOK OF PROCEDURES FOR ESTIMATING COMPUTER SYSTEM SIZING AND TIMING PARAMETERS. VOLUME 2: ADDENDUM Final Technical Report, 15 May 1979 - 15 Feb. 1980
William B. Humphrey and John N. Postak 15 Feb. 1980 175 p refs
(Contract F19628-79-C-0106)
(AD-A086140; DAI-TR-235-Vol-2; ESD-TR-80-115-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

In this volume, information about selected ESD C3 Embedded Computer Systems (ECS) is presented to illustrate the types of data that could be considered in the development of computer system analogies for sizing and timing studies. Also included are a number of graphic representations of computer system sizing and timing relationships that are based on algorithms developed by various computer scientists during the past several years. Although the relationships are presented in absolute values, users are cautioned not to consider any relationship by itself. Rather, they should be considered additional possible data points in the overall evaluation of a computer system's sizing and timing parameters. Also included are two examples of the application of the procedures discussed in volume 1: a proposed revision of the Data Item Description (DID) entitled, Computer Program Timing and Sizing Data (DI-S-30568); and a list of suggestions for future work to update and improve the estimating procedures. In addition, a reference listing, an annotated bibliography, and an index are provided. GRA

N80-32113# Los Alamos Scientific Lab., N. Mex.
IMPLEMENTING ADVANCED DATA ANALYSIS TECHNIQUES IN NEAR-REAL-TIME MATERIALS ACCOUNTING
Jack T. Markin, Alice L. Baker, and James P. Shipley 1980 10 p refs Presented at the 21st Ann. Meeting of the Inst. of Nucl. Mater. Management, Palm Beach, Fla., 30 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1816; CONF-800655-10) Avail: NTIS HC A02/MF A01

Materials accounting for special nuclear material in fuel cycle facilities is implemented more efficiently by applying decision analysis methods, based on estimation and detection theory, to analyze process data for missing material. These methods are incorporated in the computer program DECANAL, which calculates sufficient statistics containing all accounting information, sets decisions thresholds, and compares these statistics to the thresholds in testing the hypothesis H sub 0 of no missing material against the alternative H sub 1 that material is missing. DECANAL output provides alarm charts indicating the likelihood of missing material and plots of statistics that estimate materials loss. This program is a useful tool for aggregating and testing materials accounting data for timely detection of missing material. DOE

N80-32114# Royal Signals and Radar Establishment, Malvern (England).
THE TOUCH PAD: A VERSATILE COMPUTER INPUT DEVICE
R. S. Newton, A. V. Matthews, and T. C. Butler London HMSO Sep. 1979 14 p refs Sponsored by United Kingdom Civil Aviation Authority
(RSRE-Memo-3229; BR74691) Avail: NTIS HC A02/MF A01

A touch sensitive high resolution input device designed for interaction with displays is described. The active surface of the pad reacts to light finger pressure and transmits the finger

coordinates to the computer. By associating a marker on the screen with the coordinates, the marker may be tracked to coincide with a displayed object. Acceptance of the so identified object is made by simply lifting the finger. The active surface is formed from a rigid base carrying 128 parallel conductors overlaid by a flexible sheet carrying 128 orthogonal conductors. Separation is maintained by a slight air pressure. The electronics are controlled by an Intel 8080 microprocessor. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-32115 Pennsylvania Univ., Philadelphia.
***AUTOMATIC TRANSACTION DECOMPOSITION IN A* DISTRIBUTED CODASYL PROTOTYPE SYSTEM Ph.D. Thesis**
Frank Germano, Jr. 1980 243 p
Avail: Univ. Microfilms Order No. 8018547

Alternative distributed database management systems (DDBMS) architectures for the distribution of CODASYL-like structures were investigated and a prototype distributed CODASYL *architecture, DSEED was defined. To provide acceptable performance, the use of a high level data language beyond the* DML level and beyond the set level is indicated. Towards this *end, the syntax and semantics of a (FOR EACH) data language, SEEDFe, is defined. The automatic decomposition using a* preprocessor of SEEDFE programs into a front end control task *and subordinate back end tasks is described. A global view* mechanism, coupled with this decomposition process, provides geographic transparency for the application programmer. This *mechanism, whose operation is controlled by a global schema* defined by data definition facilities, guides the mapping of multiple, underlying local views to a global database view. Since *some sets in this global view can have owner and member* records which are not collocated, the notion of a distributed set is defined and a possible implementation proposed.
Dissert. Abstr.

N80-32116 California Univ., Santa Barbara.
***MODELING A SOFTWARE ENGINEERING PROJECT* MANAGEMENT SYSTEM Ph.D. Thesis**
Richard Hall Thayer 1979 751 p
Avail: Univ Microfilms Order No. 8019850

A model of a Software Engineering Project Management System was developed and then verified (or corrected) through *the use of structured case studies. The major issues opinion* survey identified 20 major problems in project management: 13 of the 20 were overwhelming major problems; 7 were problems *of a lesser magnitude. The project management survey data* (structured case studies), were also used to verify the results of the major issues opinion survey. Nine of the 20 major issues *were verified as problems, two were inconclusive, and nine were* not problems. As a result, six major issues concerning planning and one concerning controlling were judged conclusively as *problems by both surveys. It is shown that software engineering* project management has all the basic functions of any manage*ment task; that the major issues of software engineering project management can be identified and will act as road signs for* research in project management; and, that various functions and *activities of a development project can be identified that will improve the project manager's capability to deliver his project* on time, within cost, and in response to the user's needs.
Dissert. Abstr.

N80-32117# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
***TESTING COBOL PROGRAMS BY MUTATION. VOLUME* 1: INTRODUCTION TO THE CMS.1 SYSTEM M.S. Thesis**
Jeanne Marie Hanks Feb. 1980 76 p *refs*
(Contract N00014-79-C-0231; Grant DAAG29-78-G-0121)
(AD-A087310) Avail: NTIS HC A05/MF A01 CSCL 09/2

Program mutation is a testing technique which has been applied to FORTRAN programs (ABDLS). This thesis will describe the application of mutation to the COBOL language in an *automated program mutation system. The thesis will describe* the development of a COBOL Mutation System (CMS.1), its testing using FORTRAN mutation analysis, and the subset of COBOL that is supported by CMS.1. The internal representation selected to represent the COBOL source statements and a *description of the mutant operators that are implemented in* CMS.1 will also be supplied. GRA

N80-32118# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERLISP MAINTENANCE Final Report
Alice K. Hartley 1979 11 p
(Contract N00039-78-C-0300; ARPA Order 3554)
(AD-A087338; BBN-4304) Avail: NTIS HC A02/MF A01 CSCL 09/2

*INTERLISP is an exceedingly powerful programming environ*ment that makes it possible to implement large, complex systems in a very short time. The INTERLISP maintenance contract covers *the following tasks: maintenance of the system level portion of* INTERLISP, including tracking down and fixing bugs, modifying and improving existing features in response to the needs of the *ARPA community, and keeping up with hardware and operating* system changes; documentation of the system level portions of INTERLISP for inclusion in the INTERLISP manual; release of *new systems to the ARPA community; and installation of* INTERLISP in the National Software Works. GRA

N80-32119# *SRI International Corp., Menlo Park, Calif.* Computer Science Lab.
CANONICAL FORMS AND UNIFICATION Interim Report
Jean-Marie Hullot Apr. 1980 25 p refs
(Contract F49620-79-C-0099; AF Proj. 2304)
(AD-A087640; SRI/CSL-70; AFOSR-80-0506TR) Avail: NTIS *HC A02/MF A01 CSCL 09/2*

Fay has described a complete T-unification for equational theories T that possess a complete set of reductions as defined *by Knuth and Bendix. This algorithm relies essentially on using* the narrowing process defined by Lankford. This paper first studies *the relations between narrowing and unification and gives a new version of Fay's algorithm. It then shows how to eliminate* many redundancies in this algorithm and gives a sufficient condition for its termination. Finally, it is shown how to extend *the previous results to various kinds of canonical term rewriting* systems. GRA

N80-32120# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
***A CATALOGUE OF CANONICAL TERM REWRITING* SYSTEMS Interim Report**
Jean-Marie Hullot Apr. 1980 36 p refs
(Contract F49620-79-C-0099; AF Proj. 2304)
(AD-A087641; SRI/CSL-113; AFOSR-80-0460TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

It is attempted in this paper to put together some experimental results obtained by Knuth and Bendix, Lankford and Ballantyne, Peterson and Stickel, as well as to present some new results. It *does not give a theoretical study of the methods used. Thus* the reader is assumed to be familiar with the original Knuth and Bendix algorithm and its extensions. GRA

N80-32121# California Univ., Livermore. Lawrence Livermore Lab.
***GRAPHICS LIBRARY FOR REAL TIME DISPLAY AND DATA* ANALYSIS**
Hal R. Brand and Richard K. Yamauchi 15 Jan. 1980 169 p
(Contract W-7405-eng-48)
(UCID-18543) Avail: NTIS HC A08/MF A01

*A graphics library was written to plot chemical experimen*tal data in real time and to plot data analysis results interactively. The library was designed for use on Digital Equipment Corporation's RSX-11M operating system. The graphics devices were *a 17 inch cathode ray tube with light pen, a Tektronix* 4025 terminal, and a four pen plotter. DOE

N80-32122# Royal Aircraft Establishment, Farnborough (England).
***A METHOD OF INTERPOLATION USING CUBIC POLYNO*MIALS WHICH AVOIDS UNNATURAL OVERSHOOTS**

G. F. Butler London HMSO Jun. 1979 38 p refs (RAE-TM-Aero-1812; BR89581) Avail: NTIS HC A03/MF A01

Problems which can occur with the application of cubic polynomials in computer curve plotting are discussed and a coordinate rotation is proposed which avoids unnatural overshoots in the curve. A procedure is given for estimating the gradient at the given data points from local conditions and a criterion for choosing a suitable step length for plotting is introduced. A FORTRAN subroutine for calculating points on the curve is included. Author (ESA)

N80-32123# National Technical Information Service, Springfield, Va.

COMPUTER SOFTWARE RELIABILITY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - May 1980

Brian Carrigan Jun. 1980 289 p Supersedes NTIS/PS-79/067; NTIS/PS-78/0643

(PB80-811797; NTIS/PS-79/0671; NTIS/PS-78/0643) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 261 abstracts addressing computer software reliability modeling, software verification, and the evaluation of test tools for the measurement of software correctness is presented. General discussions are included. GRA

N80-32124# Illinois State Dept. of Transportation, Springfield.

EVALUATION OF INCIDENT DETECTION ALGORITHMS Final Report

Moshe Levin and Gerianne M. Krause Dec. 1979 123 p refs Sponsored by FHWA

(PB80-187255; Physical-Research-85; FHWA/IL/PR-085; IHR-005) Avail: NTIS HC A06/MF A01 CSCL 13B

Offline and online evaluations were conducted. Six algorithms were evaluated using incident and incident-free data collected on Chicago's expressways under various traffic and environmental conditions. Algorithm efficiency was evaluated in terms of detection rate, false alarm rate, and mean-time-to- Detect. The evaluation included a comparative analysis of algorithm efficiency: effect of lateral detectorization on algorithm performance; hierarchical analysis of threshold effectiveness and the effect of incident severity on algorithm performance. GRA

N80-32125# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

GUIDANCE AND CONTROL SOFTWARE

Louis J. Urban, ed. (Aeronautical Systems Div.) May 1980 221 p refs In ENGLISH and FRENCH

(AGARD-AG-258; ISBN-92-835-0267-1) Avail: NTIS HC A10/MF A01

Software design and management are discussed with respect to avionics applcations. Particular attention is given to guidance and control systems, communication systems, and weapon systems. For individual titles, see N80-32126 through N80-32142.

N80-32126# British Aerospace Aircraft Group, Preston (England).

AN APPROACH TO THE DERIVATION AND VALIDATION OF REQUIREMENTS

A. O. Ward *In* AGARD Guidance and Control Software May 1980 24 p refs (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

The problems associated with the development of requirements for guidance and control software are discussed. Ideas are suggested that will overcome these problems and a specific application of those ideas are described in terms of a methodology and associated tools. The position and contribution of requirements definition in the perspective of the overall product life cycle are examined. Two relevant viewpoints are considered: the resources needed to produce requirements; and the quality of requirements and its impact on budget. R.C.T.

N80-32127# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

TRENDS IN THE DEVELOPMENT OF SOFTWARE FOR GUIDANCE AND CONTROL

Peter F. Elzer *In* AGARD Guidance and Control Software May 1980 10 p refs (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

An attempt is made to classify the steps of the development process for computer programs in guidance and control systems. Possible methologies are identified as well as support tools for development on each level. Several existing methods are described. R.C.T.

N80-32128# Naval Air Development Center, Warminster, Pa. Advanced Software Technology Div.

A MODERN FACILITY FOR SOFTWAHE PRODUCTION AND MAINTENANCE

H. G. Stuebing *In* AGARD Guidance and Control Software May 1980 14 p refs (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

A facility was designed, developed, and used for the life cycle support of weapon system software. This facility consists of a software system which runs on a commercial multicomputer configuration. The approach features increased management visibility of the software development process, increased programmer productivity through automation, reducing the cost of change during maintenance, and the use of automated regression testing to improve software quality. R.C.T.

N80-32129# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

LOGIC STRUCTURE FOR TESTABILITY AND FAILURE DETECTION

U. Schulz and A. Roelker *In* AGARD Guidance and Control Software May 1980 8 p (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

A concept of the logic structure for testability and failure detection of digital, modular, onboard data acquisition and control units within avionics systems were investigated. The concept was developed according to the maintenance levels within the German Air Force. The tests and failure detection were performed during operation as well as during pre- and post-flight tests without additional external special to type test equipments. The tests were totally integrated into the avionic system. R.C.T.

N80-32130# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.

THE UNITED STATES DEPARTMENT OF DEFENSE COMMON HIGH ORDER LANGUAGE

David A. Fisher *In* AGARD Guidance and Control Software May 1980 9 p refs (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

The design, development, aquisition, management, and operational support and maintenance of computer software are discussed with respect to avionics applications. Specific emphasis is given to major weapon systems, communications systems, and command control systems. R.C.T.

N80-32131# Softech, Inc., Waltham, Mass.

COMPILER WRITING TECHNIQUES FOR AVIONICS APPLICATIONS

Raymond J. Rubey and Barry L. Wolman *In* AGARD Guidance and Control Software May 1980 8 p refs (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

Some of the options in compiler construction for avionics applications are reveiwed and the structure of a typical compiler is described. Major emphasis is placed on the significant differences which exist between compilers for avionics applications and compilers used in general purpose applications. R.C.T.

N80-32132# Software Management Consultants, Torrance, Calif.

SOFTWARE VERIFICATION AND VALIDATION

Donald J. Reifer *In* AGARD Guidance and Control Software May 1980 13 p refs (For primary document see N80-32125 22-61)

Avail: NTIS HC A10/MF A01

The terms verification and validation are described and detailed guidance for their conduct is given. For each activity, the responsibilities of the participating organizations are identified

and applicable concepts, methods, products and problems are discussed. R.C.T.

N80-32133# Naval Air Development Center, Warminster, Pa.
SOFTWARE MAINTENANCE MANAGEMENT PROCESS
William R. Bogdan *In* AGARD Guidance and Control Software May 1980 9 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The management concepts utilized in developing a maintenance capability to support fleet tactical software are addressed. The tactical software being maintained is described and the kind of management planning that is essential to fleet software maintenance is presented. Software design factors are discussed that will reduce maintenance costs by making the initial software development more amenable to subsequent modification. The methodology the Navy uses to control changes to a software configuration baseline is addressed and how the Navy insures reliability of the software prior to fleet release is included. Also provided is an overview for the work breakdown structure and the organization of resources for work accomplishment. Estimating procedures are described for determining software maintenance cost. R.C.T.

N80-32134# National Aerospace Lab., Amsterdam (Netherlands). IRAS Mission Operations.
DATA SYSTEM FOR THE INFRA-RED ASTRONOMICAL SATELLITE (IRAS)
R. C. VanHoltz *In* AGARD Guidance and Control Software May 1980 21 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The data system that is being developed for the Infra-Red Astronomical Satellite (IRAS) is discussed. After introducing the satellite and its objectives, the setup of the on board and the ground data system is described. The subsystem responsible for the control of the satellite, called IRAS Ground Operations, is then exposed in more detail. The tasks of this subsystem include orbit determination and prediction, real time operations, spacecraft performance evaluation and maintenance, and data preprocessing, distribution, and filing. Finally, the data system configuration control mechanism which was devised to meet the complexity and multinational setup of the system is portrayed. M.G.

N80-32135# General Dynamics Corp. Fort Worth, Tex.
ADVANCED DESIGN CONCEPTS AND PRACTICES IN THE F-16 MISSION COMPUTER SOFTWARE
Judith A. Edwards *In* AGARD Guidance and Control Software May 1980 15 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

Developments in the design of the F-16 mission computer software are discussed. Improved system performance resulted from several broad-scope software design decisions that were applied to the mission computer for the F-16 avionics system. These design decisions were made in the areas of the control and scheduling functions. The selected control concepts relied upon a table-driven system that employed only positive logic and a simplified executive. The Multicomputer configuration was a loosely coupled in an asynchronous network. Communications in the network were implemented via a standard 16-bit protocol. Data consistency was addressed in the basic interface specification as well as the detailed implementation. In general, the timing and hardware design features were hidden from the algorithms through system control approaches. In all, the flexibility and optimizations that resulted from the implementation concept have been well established through two block updates and several demonstration and research programs. M.G.

N80-32136# Ministry of Defence, London (England).
MAIN COMPUTER SOFTWARE FOR THE MRCA TORNADO
K. Sanderson *In* AGARD Guidance and Control Software May 1980 16 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The main computer software for the tri-national requirement Tornado (Panavia 200 MRCA Tornado) is discussed. Particular reference is made to the role of the national avionic system companies in the participating nations and the organization provided by them for the design and development of the avionic system, including the software. The specification of the top level avionic design requirements and a description of the computing hardware and data transmission arrangements provide an introduction to the specific software development topics. These cover the specification of the software requirements, the development of the Operational Flight Program, the software structure and documentation, hardware-software integration and testing facilities, documentation for the control and reporting of the testing, configuration control aspects, and production software modification control. M.G.

N80-32137# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
THE LOGIC OF THE ELECTRIC FLIGHT CONTROL SYSTEM EXPERIMENT ON THE CONCORDE [LOGICIEL DU SYSTEME DE COMMANDE DE VOL ELECTRIQUE EXPERIMENTE SUR CONCORDE]
Y. Negre and J. Raullet *In* AGARD Guidance and Control Software May 1980 11 p In FRENCH (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

An experiment using a numerical electric flight control system to control low speed longitudinal instability on the Concorde is described. The security and performance objectives which influenced the system definition are outlined with particular emphasis on problems related to the definition, installation and experimentation with the logic used. Conclusions are drawn principally regarding the level of security which can be expected for onboard logical elements. Transl. by A.R.H.

N80-32138# Smiths Industries Ltd., Bishops Cleeve (England). Electronic Displays Branch.
DESIGN AND DEVELOPMENT OF SOFTWARE FOR SEA HARRIER HUDWAC
E. P. Jones and S. Howison *In* AGARD Guidance and Control Software May 1980 12 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The development of the airborne software for the Sea Harrier Head-Up Display and Weapon Aiming Computer System is described. The system requirements are outlined and include the symbology generation for both head-up and head-down display systems; weapon aiming computations; flight path guidance for both target interception and aircraft to ship recovery; pointing and control commands for radar and guided weapons; first line avionic system test and fault identification; and extensive operational self test and failure tolerance. The hardware configuration, software design, and software writing utilizing the CORAL programming language are discussed. M.G.

N80-32139# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SOFTWARE FOR A DIGITAL INTEGRATED FLIGHT CONTROL AND NIGHT VISION SYSTEM FOR MILITARY HELICOPTERS
P. Elzer, F. Figel, and W. Hoffman *In* AGARD Guidance and Control Software May 1980 8 p refs Sponsored by the German Federal Ministry of Defense (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The functions and structure of an integrated digital flight control and night vision system for military helicopters is described. Its partially redundant components are connected via a serial bus. This resulted in a system with distributed processors. The software had to be structured according to the distributed character of the system and had to take into account the master-terminal principle of the bus architecture. It comprises the algorithms for flight control and handling of the night vision equipment as well as management functions for the bus, the displays, input commands, and error handling. Development of the software and integration of the system were supported by appropriate hardware aids. A special device was developed to facilitate integration of the distributed system. For this the same modular electronic components were used as for the control system. M.G.

N80-32140# IBM Federal Systems Div., Owego, N. Y.
SPACE SHUTTLE APPLICATIONS. PART 1: REDUNDANT

COMPUTER OPERATION. PART 2: REDUNDANT COMPUTER SOFTWARE DESIGN AND TEST
Robert E. Poupard and Caroline T. Sheridan *In* AGARD Guidance and Control Software May 1980 9 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The operational characteristics of the space shuttle redundant data processing system are defined. The system was designed to meet the fail operational/fail safe requirements of the space shuttle mission and is comprised of a redundant set of four IBM AP-101 general purpose computers programmed to produce identical, simultaneous output commands. Particular emphasis is given to the design testing of the system software. Additional design characteristics, namely the incorporation of asynchronous interrupts and multiple asynchronous priority levels, are examined and techniques utilized for ensuring data integrity are reviewed. M.G.

N80-32141# Naval Air Development Center, Warminster, Pa. Combat Systems Software Div.
SOFTWARE APPLICATIONS AS DEMONSTRATED IN THE P-3C AVIONICS SYSTEM
John W. Heap *In* AGARD Guidance and Control Software May 1980 15 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The software management methodology developed for generation of the P-3C system software for the three UPDATE versions of the avionics system is covered. Emphasis is placed on the software development flow process depicting control points and deliverables, standards and objectives set for the software functions and design, the contracting strategy, and tool and facilities employed. M.G.

N80-32142# Boeing Military Airplane Development, Seattle, Wash.
EXECUTIVE SOFTWARE REUSABILITY FOR DISTRIBUTED AVIONICS ARCHITECTURES
R. F. Bousley *In* AGARD Guidance and Control Software May 1980 12 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The impact of distributed microprocessor-based systems integrated (mission-oriented) avionics software is addressed. An overview is given of hardware networks and bus control mechanization issues in distributed architectures. Executive software considerations are emphasized. It appears that a functional decomposition of the executive software will help to maximize the reusability of this software since only those functional modules changed. A modularized executive, along with a firm executive/applications software interface, will allow maximum reusability of the applications software. This will minimize the impact on the integration task during mission software development. M.G.

62 COMPUTER SYSTEMS

Includes computer networks.

N80-32143 Cincinnati Univ., Ohio.
A FAST ANALYSIS AND MODIFICATION ALGORITHM FOR COMPUTER AIDED DESIGN OF LARGE SCALE NETWORKS Ph.D. Thesis
Chin-Fu Chen 1980 240 p
Avail: Univ. Microfilms Order No. 8021067

A fast algorithm for network analysis is developed; it merges the conventional two phase approach into one process. The LU-factors (and their inverses) of a network matrix are built up through a branch by branch reconstruction of the given network. This fast algorithm, called Successive LU Decomposition or SLUD, is derived through the concept of tearing and generalized network formulation. There is no need to find the LU-factors of the whole Jacobian matrix. The computation speed for circuit analysis including the dc, ac, transient and eigenvalue problems substantially improved. For large scale networks with repetitive subnetworks the saving in computation time and memory requirement is even more significant. Based on the SLUD concept an algorithm for constitutive modifications is developed. A circuit simulation program was implemented in PL/I and several examples are presented. As compared with the conventional approach, the SLUD algorithm has demonstrated a saving of 40% in computation time for the dc analysis of a 60 branch network. Dissert. Abstr.

N80-32144 Carnegie-Mellon Univ., Pittsburgh, Pa.
PARTITIONING AND COOPERATION IN A DISTRIBUTED MULTIPROCESSOR OPERATING SYSTEM: MEDUSA Ph.D. Thesis
John Kenneth Ousterhout 1980 161 p
Avail: Univ. Microfilms Order No. 8020166

The design of Medusa, an operating system with a highly distributed control structure that runs on the Cm multimicroprocessor is analyzed. The Cm hardware is distributed, yet extremely flexible in the kinds of interprocessor communication it permits. Thus Medusa's structure arose from a consideration of two issues: partitioning and cooperation. Medusa consists of five relatively independent utilities that execute on different processors. Each utility provides one abstraction for the rest of the system and communicates with user programs and other utilities via messages. Functions are distributed between utilities at a very low abstract level. Since processors in cm are plentiful but small, all programs, including the utilities, are organized as task forces that contain several concurrent, cooperating activities. Medusa attempts to make cooperation between activities of a task force both powerful and efficient. One mechanism for this is executing all runnable activities of the task force and also executing each on a different processor. Dissert. Abstr.

N80-32145*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
OVERVIEW OF INTEGRATED PROGRAMS FOR AEROSPACE-VEHICLE DESIGN (IPAD)
Robert E. Fulton Washington Sep. 1980 23 p refs Presented at IPAD Natl. Symp., Denver, 17-19 Sep. 1980
(NASA-TM-81874; L-14022) Avail: NTIS HC A02/MF A01 CSCL 09B

An overview of a joint industry/government project, denoted Integrated Programs for Aerospace-Vehicle Design (IPAD), which focuses on development of technology and associated software for integrated company-wide management of engineering information is presented. Results to date are summarized and include an in-depth documentation of a representative design process for a large engineering project, the definition and design of computer-aided design software needed to support that process, and the release of prototype software to integrated selected design functions. M.G.

N80-32148# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
APPLICATIONS OF INFORMATION THEORY TO DATA COMMUNICATION NETWORKS
Robert G. Gallager Jul. 1980 24 p refs Presented at NATO Advan. Study Inst., Norwick, England, 4-14 Aug. 1980
(Contract N00014-75-C-1183; Grant NSF ECS-79-19880; ARPA Order 3045; NR Proj. 049-383)
(AD-A087624; LIDS-P-1017) Avail: NTIS HC A02/MF A01 CSCL 09/2

The use of information theory in the study of Data Communication Networks can be roughly divided into two parts. The first deals with usual information theoretic problem of reliable and efficient transmission of information, generalized to treat multiple sources and destination. The second deals with the special problems caused by the bursty sources typical of data networks. These sources typically produce short messages interspersed with long and unpredictable intervals of silence. This makes the sources highly nonstationary over time intervals comparable to tolerable communication delays. This lecture will deal primarily with this second class of issues. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-32147 Notre Dame Univ., Ind.
ON THE TOTAL SYNTHESIS PROBLEM OF LINEAR MULTIVARIABLE CONTROL Ph.D. Thesis
Raghvendra Ramchandra Gejji 1980 204 p
Avail: Univ. Microfilms Order No. 8020961

The algebraic structure behind the basic total synthesis problem (TSP) is established. The fundamental mapping of TSP is introduced and a characterization of the solution set of TSP is given as a rational vector space. It is shown that solutions that provide for internal stability must be in a particular subset which is a free module over a ring of fractions formed from polynomials. Coefficients are considered as the field of reals. The utility of a minimal polynomial basis in characterizing the above subset is described. The problem of subjective criteria in calculation of minimal bases is discussed, and a case study which leads to an empirical balancing rule for countering this problem is presented. Design is approached as an approximation technique using least squares methods to select, among the feasible solutions, the nearest neighbor to a specified target performance. A question arising as a result is whether control goals may be incorporated in the specified target performance. An example result on how tracking goals lead to constraints on the closed loop transfer function matrix is therefore included. A comprehensive example is included. Dissert. Abstr.

N80-32148*# Honeywell Systems and Research Center, Minneapolis, Minn.
ROBUSTNESS OF MULTILOOP LINEAR FEEDBACK SYSTEMS
J. C. Doyle 31 Aug. 1979 27 p refs 2 Vol.
(Grant NG-1323; Contracts N00014-75-C-0144; E(11-1)-3070) (NASA-CR-163450; AD-A086581) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a new approach to the analysis of robustness or sensitivity of multiloop linear feedback systems. The properties of the return difference equation are examined using the concepts of singular values, singular vectors and the spectral norm of a matrix. A number of new tools for multiloop systems are developed which are analogous to those for scalar Nyquist and Bode analysis, providing a generalization of the scalar frequency-domain notions such as stability margins and M circles. GRA

N80-32149# Colorado Univ., Boulder.
QUANTITATIVE SYNTHESIS OF UNCERTAIN MULTIPLE INPUT-OUTPUT FEEDBACK SYSTEM
Isaac M. Horowitz (Weizmann Inst. of Science, Rehovot, Israel) 31 Aug. 1979 51 p refs
(Grant AF-AFOSR-2946-76)
(AD-A087014) Avail: NTIS HC A04/MF A01 CSCL 09/2

An n input, n output plant is given with a specified range of parameter uncertainty and specified tolerances on the n to the 2nd power system response to command functions and the n to the 2nd power response to disturbance functions. It is shown how Schauder's fixed point theorem may be used to generate a variety of synthesis techniques, for a large class of such plants. The design guarantees the specifications are satisfied over the range of parameter uncertainty. An attractive property is that design execution is that of successive single loop designs, with no interaction between them and no iteration necessary. Stability over the range of parameter uncertainty is automatically included. By additional use of Schauder's theorem, these same synthesis techniques can be rigorously used for quantitative design in the same sense as above, for n x n uncertain nonlinear plants, even nonlinear time varying plants, in response to a finite number of inputs. The latter approach is sufficient. However, a scientific theory of feedback should certainly include quantitative design techniques. In this paper, it is shown how Schauder's fixed point theorem can be used to generate a variety of precise quantitative mio synthesis techniques suitable for various problem classes. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-32150# Magnetic Observatory, Hermanus (South Africa).
WORKSHOP ON DIGITAL TIME SERIES ANALYSIS WITH GEOPHYSICAL APPLICATIONS
5 Jun. 1980 293 p refs Workshop held at Hermanus, South Africa, 22-24 Apr. 1980
(CSIR-S-238; ISBN-0-7988-1889-1) Avail: NTIS HC A13/MF A01

Fourier transforms, digital filtering, and maximum entropy spectral analysis are among the principal topics discussed in twenty-two unedited papers. The use of these techniques in astronomical photometry and in seismology is discussed. Other applications of time series analysis such as predicting rainfall in South Africa, determining the resonance of Table Bay harbor, analyzing geomagnetic pulsations, measuring ocean surface waves, differentiating noisy data, and measuring vector currents, the autocorrelation analysis of atmospheric pressure, and a digital autocorrelation spectrometer and radio astronomical spectral analysis are also considered. A.R.H.

N80-32151# Stanford Univ., Calif. Systems Optimization Lab.
COMPUTING FINITE-DIFFERENCE APPROXIMATIONS TO DERIVATIVES FOR NUMERICAL OPTIMIZATION
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright May 1980 27 p refs
(Contracts N00014-75-C-0267; DAAG29-79-C-0110; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-79-26009; NSF ENG-77-06761)
(AD-A087428; SU-SOL-80-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

Finite-difference approximations to derivatives are useful not only in optimization algorithms, but also in other circumstances such as sensitivity analysis. In this paper we discuss methods for estimating the relative cancellation error and relative truncation error in a finite-difference approximation and propose a technique for computing the finite-difference interval so that the bounds upon the errors are balanced. We also propose a method for choosing the finite-difference interval in a quasi-Newton algorithm for unconstrained minimization that uses function values only. GRA

N80-32152# Naval Ship Research and Development Center, Bethesda, Md. Computation, Mathematics and Logistics Dept.
FINITE ELEMENT ANALYSIS OF PIPING TEES Final Report, Oct. 1979 - Jun. 1980
Antonio J. Quezon, Gordon C. Everstine, and Michael E. Golden Jun. 1980 49 p refs
(AD-A087353; DTNSRDC/CMLD-80/11) Avail: NTIS HC A03/MF A01 CSCL 13/11

Finite element analyses were performed for a 24 in. x 24 in. x 10 in. schedule 40 carbon steel piping tee subjected to five orthogonal forces, six orthogonal moments, and internal pressure. The NASTRAN and CORTES/SA computer programs were used to compute displacements and normalized principal stresses for four finite element models. (CORTES/SA is a special purpose finite element analysis program for tee joints developed at the University of California at Berkeley.) The first three models generated were analyzed by NASTRAN, and the third and fourth models were analyzed by CORTES/SA, resulting in a total of five finite element analyses. Flexibility factors and normalized principal stresses were then compared to experimentally obtained results. One of the four models investigated was generated from actual measured geometry using GPRIME, a geometric and finite element modeling system developed at DTNSRDC. The other three models were generated from an idealized tee using the data generator contained in CORTES/SA. The generation by GPRIME of the finite element model from actual geometry was more difficult and expensive than the generation of CORTES/SA of an idealized model of the tee. In addition, the idealized model proved to be adequate when analyzed by NASTRAN. GRA

N80-32153# Naval Postgraduate School, Monterey, Calif.
SIMULATION OF SOME AUTOREGRESSIVE MARKOVIAN SEQUENCES OF POSITIVE RANDOM VARIABLES
Peter A. W. Lewis and A. J. Lawrance Oct. 1979 29 p refs Presented at Winter Simulation Conf., Dec. 1979
(NR Proj. 042-284; RR0000110)
(AD-A087368; NPS55-79-024) Avail: NTIS HC A03/MF A01 CSCL 12/1

Methods for simulating dependent sequences of continuous positive valued random variables with exponential, Gamma, mixed exponential and uniform marginal distributions are given. In most cases the sequences are first order, linear autoregressive, Markovian processes. A two parameter family of this type with exponential marginals is defined and its transformation to a similar multiplicative process with uniform marginals is given. It is shown that for a subclass of this two parameter family extension to mixed exponential marginals is possible, giving a model of broad applicability for analyzing data and modelling stochastic systems. Efficient simulation of some of these schemes is discussed. GRA

N80-32154# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Research.
REGRESSION-ADJUSTED ESTIMATES FOR REGENERATIVE SIMULATIONS, WITH GRAPHICS
Peter A. W. Lewis and P. Heidelberger (IBM, Yorktown Heights, N.Y.) Apr. 1980 55 p refs
(NR Proj. 042-084)
(AD-A087369; NPS55-80-019) Avail: NTIS HC A04/MF A01 CSCL 12/1

The independent block structure of regenerative processes and the known convergence rates of the means of ratio estimators are exploited to produce bias free regression adjusted estimates (rare's) for regenerative simulations. Direct assessments of the variances of the estimates are obtained, as well as indications, both formal and graphical, of their normality or nonnormality. GRA

N80-32155# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
ON THE NUMERICAL INTEGRATION OF TWO-POINT BOUNDARY VALUE PROBLEMS FOR STIFF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
Joseph E. Flaherty and Robert E. OMalley, Jr. (Arizona Univ., Tucson) Jun. 1980 11 p refs Presented at Intern. Conf. on Boundary and Interior Layers, Dublin, 3-6 Jun. 1980
(Contract N00014-76-C-0326; Grant AF-AFOSR-0192-80; NR Proj. 041-466)
(AD-A087396; Rept-30) Avail: NTIS HC A02/MF A01 CSCL 12/1

A class of two point boundary value problems are considered for systems for the form dx = f(x, y, t, epsilon), edy = g sub 1 (x, t, epsilon) + g sub 2 (x, t, epsilon)y where the matrix g sub 2 (x, t, 0) has a hyperbolic splitting with a fixed number of stable and unstable eigenvalues. Solutions to such boundary value problems can then be expected to have boundary layer behavior near both endpoints in the limit epsilon approaches 0(+). Our analysis shows, in particular, how to determine the reduced order boundary value problem satisfied by the limiting interior solution. Orthogonal matrix methods are used to determine this reduced problem and appropriate boundary layer corrections in a computationally effective manner. Numerical experiments with model problems illustrate the possibility of multiple solutions and show how our asymptotic results can be used in combination with the COLSYS code for solving two point problems via collocation. GRA

N80-32156# Pennsylvania Univ., Philadelphia. Dept. of Systems Engineering.
ROBUST AND QUANTIZED WIENER FILTERS FOR p-POINT SPECTRAL CLASSES Interim Report
Leonard J. Cimini and Saleem A. Kassam 1980 7 p refs Presented at Conf. on Inform. Sci. and Systems, Princeton, N.J., Mar. 1980 Submitted for publication
(Grant AF-AFOSR-3154-77)
(AD-A086409; AFOSR-80-0425TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The classical solution for linear estimation of a signal in additive noise is given by the well known Wiener filter. In certain circumstances, however, it is advantageous to have a filter which is piecewise constant and which provides good performance over an entire class of signal and noise power spectral densities. First, a procedure is presented for determining the optimal piecewise constant filter. Then, for a particular class of power spectral densities, termed the p-point spectral class, the robust filter is determined. GRA

N80-32157# Pennsylvania Univ., Philadelphia. Dept of Systems Engineering.
ROBUST WIENER FILTERS FOR CORRELATED SIGNALS AND NOISE Interim Report
George Moustakides and Saleem A. Kassam 1980 7 p refs Presented at Conf. on Inform. Sci. and Systems, Princeton, N.J., Mar. 1980 Submitted for publication
(Grant AF-AFOSR-3154-77; AF Proj. 2304)
(AD-A086410; AFOSR-80-0426TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this report, the Wiener filtering problem, when the cross spectral density matrix of the signal and noise is not exactly known is considered the filters which are saddle point solutions for the criterion of performance (mean square error, MSE) over the classes of allowable density matrices are obtained. Solutions for various classes are also given. GRA

N80-32158# Stanford Univ., Calif.
METHODS FOR LARGE-SCALE NONLINEAR OPTIMIZATION
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright May 1980 25 p refs Presented at the SIAM Conf. on Elec. Power Probl: The Mathematical Challenge, Seattle, Mar. 1980
(Contracts DAAG29-79-C-0110; N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018)
(AD-A087555; SU-SOL-80-8; ARO-16470.13-M)
HC A02/MF A01 CSCL 12/1

The application of optimization to electrical power technology often requires the numerical solution of systems that are very large and possibly nondifferentiable. A brief survey of the state-of-the-art of numerical optimization is presented in which those methods that are directly applicable to power system problems will be highlighted. The areas of current research that are most likely to yield direct benefit to practical computation are identified. The paper concludes with a survey of available software. GRA

N80-32159# Stanford Univ., Calif. Systems Optimization Lab.
ASPECTS OF MATHEMATICAL MODELING RELATED TO OPTIMIZATION
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright May 1980 35 p refs Presented at the Conf. on Software for Numerical Optimization, London, Mar. 1978
(Contracts DAAG29-79-C-0110; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-79-26009; NSF ENG-77-06761)
(AD-A087556; SU-SOL-80-7; ARO-16470.12-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many practical optimization problems involve mathematical models of complex real-world phenomena. This paper discusses some aspects of modeling that influence the performance of optimization methods. Information and advice are given concerning the construction of smooth models, the transformation of an optimization problem from one category to another, scaling, formulation of constraints, and techniques for special types of models. GRA

N80-32160# Naval Ocean Systems Center, San Diego, Calif.
RECURSIVE LEAST SQUARES LATTICE ALGORITHMS: A GEOMETRICAL APPROACH Final Report, Jul. - Aug. 1979
M. J. Shensa 15 Dec. 1979 20 p refs
(AD-A087566; NOSC/TR-552) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several time-recursive least squares algorithms have been developed in recent years. In this report a geometrical formalism is defined which utilizes a nested family of metric spaces indexed by the data time interval. This approach leads to a simplified derivation of the so-called recursive least squares lattices

algorithms (recursive in time and order). In particular, it is found that the resulting structure provides a single framework which encompasses an entire family of fairly complex algorithms as well as providing geometrical insight into their behavior. GRA

N80-32161# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
AN EFFICIENT METHOD FOR PERFORMING PARTIAL FRACTION EXPANSION
John F. Mahoney Feb. 1980 16 p refs
(Contract DAAG29-79-C-0119)
(AD-A087486; RR-80-11; ARO-16356.5-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

An escalation method for performing partial fraction expansions is presented for the case that the complete list of zeros of the denominator of the proper rational function is known. Expressions for the number of divisions and multiplications required are developed. The new method requires fewer such arithmetic operations than does the method of Henrici. A numerical example is provided. GRA

N80-32162# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
THE METHOD OF CONTRACTING ELLIPSOIDS
James E. Falk 18 Apr. 1980 38 p refs
(Contract DAAG29-79-C-0062)
(AD-A087485; Serial-T-418; ARO-16229.3-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The details of 'Khachian's Algorithm," or the 'Russian Algorithm", are derived. Previously reported results based on 'deep cuts' are verified, and a proof of the polynomial convergence properties is sketched. GRA

N80-32163# Sandia Labs., Livermore, Calif. Applied Mechanics Div.
REVIEW OF STIFFNESS AND IMPLICIT FINITE DIFFERENCE METHODS IN COMBUSTION MODELING
R. J. Kee and H. A. Dwyer (California Univ., Davis) Apr. 1980 82 p refs Presented at the 7th Colloq. on Gasdyn. of Explosions and Reactive systems, Goettingen, West Germany, 19 Aug. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-8623) Avail: NTIS HC A05/MF A01

A physical interpretation of stiffness in chemical kinetics modeling is presented. A general overview of the mathematical concepts important to the implementation of implicit methods is presented. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-32164 Vermont Univ. and State Agricultural Coll., Burlington.
NONPARAMETRIC ESTIMATION OF A LIFETIME DISTRIBUTION VIA THE RENEWAL FUNCTION Ph.D. Thesis
David Charles Trindade 1980 207 p
Avail: Univ. Microfilms Order No. 8018168

A group of N systems, each system consisting of c similar components is considered. The components fail independently with a cumulative lifetime distribution function (CDF) denoted by F(t) and a nonparametric estimate of F(t) from system lifetime data is developed. Cases are considered in which only system fail times, and not the fail times of the individual components are recorded. The practical implication of this process is that after the first replacement on a system has been made, it is not possible to ascertain from the recorded system fail times whether the failure occurred on an original or replaced item. However, is is shown that there is a function called the renewal function, which can be estimated directly for this pooled process and then used to estimate the component CDF. The pooling of systems with different entry times into operation result in different current operating times, and hence progressive or multiple censoring of groups of component lifetimes. The renewal function M(t) is defined as the expected number of component renewals or replacements by time t at a single component position. The CDF F(t) can be determined from M(t) via a well known equation called the fundamental renewal function. Dissert. Abstr.

N80-32165 Cornell Univ., Ithaca, N. Y.
ON THE THEORY OF CROSSOVER DESIGNS WITH RESIDUAL EFFECTS Ph.D. Thesis
Ronald Paul Kershner 1980 189 p
Avail: Univ. Microfilms Order No. 8020842

Five key areas in the theory of crossover designs with residual effects are addressed. These areas are: (1) a general discussion of the nature of repeated measures designs and the various types of treatment effects that might arise in such application; (2) a restructuring of the intraclass correlation covariance structure as it pertains to repeated measurements applications; (3) a detailed discussion of certain inherent estimability problems that arise in linear models containing residual treatment effects; (4) resolution of the currant controversy surrounding the two treatment crossover designs; and (5) a fresh look at some published designs for three and four treatments with a view toward assessing variance optimality and estimability of certain interaction effects for a varying number of treatment periods. Dissert. Abstr.

N80-32166 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE CAUSAL ANALYSIS OF MULTIPLE TIME SERIES: A FREQUENCY DOMAIN APPROACH USING GROUP DELAY Ph.D. Thesis
Michael Lee Deaton 1980 118 p
Avail: Univ. Microfilms Order No. 8020203

An alternative notion of causality between two processes called local causality is given and is shown to overcome the difficulties in the Wiener/Granger approach. A test for local causal relations is proposed. The main features of the new definition are that it describes causal relations between frequency components of two stochastic processes and that it uses the previously seldom used group delay function. The definition rests heavily upon the interpretation of the group delay function as a measure of the lead lag relationships between the frequency components of two stochastic processes. This interpretation has been hinted at in the literature without strict justification. A rigorous development of this interpretation is given. For describing the lead lag relationships between multivariate processes, the partial group delay function is defined and shown to have an interpretation as a lead lag indicator for frequency components of multivariate stochastic processes. Using the partial group delay function, a definition of local causality among multivariate processes is given. An estimator for the partial group delay function is proposed. Dissert. Abstr.

N80-32167 California Univ., Riverside.
A BAYESIAN PROCEDURE TO COMPARE AND CHOOSE AMONG LOGISTIC REGRESSION MODELS Ph.D. Thesis
Francisco Garcia-Hernandez 1980 88 p
Avail: Univ. Microfilms Order No. 8020607

A Bayesian procedure based on the posterior odds ratio is developed. This procedure is applied to two cases of model specifications: (1) to select from a given set the best subset of explanatory variables; and (2) to select the best of two alternative sets of explanatory variables. The posterior odds ratio procedure was applied to select the best subset of a given set of explanatory variables when the dependent variable is the married woman's participation in the labor force and to compare two alternative theories that explain the participation of married women in the labor force. The results obtained in the empirical analysis are very encouraging. The procedure discriminates very well between a good model and a bad model. Dissert. Abstr.

N80-32168 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
THE APPLICATION OF CLUSTER ANALYSIS TO THE MASS APPRAISAL OF FOREST AND VACANT LAND Ph.D. Thesis
Susan Gail Stafford 1979 204 p
Avail: Univ. Microfilms Order No. 8019083

Cluster analysis, in conjunction with multiple regression techniques and discriminant analysis is used to improve the market value estimates for vacant and forest land. Sales data from three upstate New York counties were merged into one master file.

Inter-county data filters were devised to reduce any problems with inter-county variable definition incompatibility. Half of the data was clustered into several (8) small clusters. The inter-property resemblance measures were based on ten variables. Regression equations were determined of each cluster. Analysis of regression techniques were used to evaluate similarities among the regression coefficients. Clusters were combined where appropriate discriminant analysis was used to locate the clusters. The other half of the data was assigned to the appropriate cluster on the basis of the classification functions from discriminant analysis. Those properties which were initially clustered and those which were classified into the same cluster were combined. Final regression equations were computed for the three overall clusters. Dissert. Abstr.

N80-32169# Colorado State Univ., Fort Collins. Dept. of Statistics.

TESTING FOR A CHANGE POINT Ph.D. Thesis

Nancy Jean Farden and L. L. Scharf Apr. 1980 181 p refs (Contract N00014-75-C-0518)

(AD-A087111; ONR-TR-19) Avail: NTIS HC A09/MF A01 CSCL 12/2

A nonparametric procedure based on differences of averages was proposed to test for a change in the location parameter of the distribution for a sequence of independent random variables. It is assumed that at most one change may have occurred and that the point of change is an unknown parameter; the initial value of the location parameter is assumed known. A method of testing for a change point for small sample sizes which is easy to use and which will detect a change quickly was obtained. Exact critical regions were tabulated for a less than or equal to 20; the power of the tests and properties of the estimator for the change point was studied. Appropriate design of experiments for detecting change points are suggested. T.M.

N80-32170# Purdue Univ., Lafayette, Ind. School of Industrial Engineering.

BATCH SIZE EFFECTS IN THE ANALYSIS OF SIMULATION OUTPUT

Bruce Schmeise Jun. 1980 28 p refs (Contract N00014-79-C-0832)

(AD-A087045) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers the effects of using fewer batches than are necessary to satisfy normality and independence assumptions. Using too few batches results in (1) correct probability of covering the mean, (2) an increase in expected half length, (3) an increase in the standard deviation of the half length, and (4) an increase in the probability of covering incorrect values of the mean (analogous to Type II error in hypothesis testing). These effects, quantified here, are shown to be small when at least eight to ten batches are used, with least effect on confidence intervals having low confidence values. With the effects of using too few batches quantified, a simulation practitioner can make the trade off between the ease of using very few batches with known independence and normality versus using a batching algorithm to squeeze some remaining information from the data. For researchers developing batching algorithms, the results are useful in selecting initial batch sizes. The results may also be useful in the context of using independent replications to establish confidence intervals on the mean. Finally, some criteria and a procedure are suggested for Monte Carlo comparison of confidence interval procedures. These suggestions are not restricted to batch mean algorithms. GRA

N80-32171# Claremont Mens Coll., Calif. Inst. of Decision Science.

A COMPARISON BETWEEN MLE AND BLUE FOR A DECREASING FAILURE RATE DISTRIBUTION WHEN USING CENSORED-DATA

James Lucke, Janet Myhre, Sam Saunders (Washington State Univ.), and Patrick Williams Mar. 1980 25 p refs (Contract N00014-78-C-0213)

(AD-A087359; Rept-80-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

Estimation procedures for the shape and scale parameters of a mixed exponential, decreasing failure rate distribution are compared and the more advantageous methods are determined for various situations. The maximum likelihood estimate, MLE, is slightly more accurate than Best Linear Unbiased Estimator of the scale parameter based on the first K order statistics. In the joint case the MLE's are much superior to other possible estimates of the distribution. GRA

N80-32172# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.

STOCHASTIC ORDERING AND A CLASS OF MULTIVARIATE NEW BETTER THAN USED DISTRIBUTIONS Interim Report

Emad El-Neweihi Jun. 1980 29 p refs (Grant AF-AFOSR-3050-76; AF Proj. 2304)

(AD-A087288; AFOSR-80-0560TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new characterization for the univariate class of new better than used (NBU) distributions in terms of stochastic ordering is introduced. A multivariate version of this characterization is then used to define a multivariate class of NBU distributions. Basic properties of this class are derived. Comparison and relationships of this new class with earlier classes are developed. Two multivariate new worse than used (NMW) classes of life distributions are defined and compared and their basic properties are studied. GRA

N80-32173# California Univ., Berkeley. Operations Research Center.

THE BAYESIAN APPROACH TO STATISTICS

Dennis V. Lindley May 1980 42 p refs Presented at Symp. on Recent Advances in Statistics, Lisbon, Apr. 1980 (Grant AF-AFOSR-3179-77; AF Proj. 2304)

(AD-A087836; ORC-80-9) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper discusses several topics that arise in applying Bayesian ideas to inference problems. The Bayesian paradigm is first described as an appreciation of the world through probability: probability being expressed in terms of gambles. Various justifications for this view are outlined. The role of models in the specification of probabilities is considered; together with related problems of the size and complexity of the model, robustness and goodness of fit. Some attempt is made to clarify the concept of conditioning in probability statements. The role of the second argument in a probability function is emphasized again in discussion of the likelihood principle. The relationship between the probability specification and real-world experiences is explored and a suggestion is made that zero probabilities are, in a sense, unreasonable. It is pointed out that it is unrealistic to think of probability as necessarily being defined over a sigma-field. The paper concludes with some remarks on two common objections to the Bayesian view. GRA

N80-32174# Tennessee Univ., Knoxville. Dept. of Psychology.

IS BAYESIAN ESTIMATION PROPER FOR ESTIMATING THE INDIVIDUAL'S ABILITY

Fumiko Samejima 15 Jul. 1980 153 p refs (Contract N00014-77-C-0360; RR0420401; NR Proj. 150-402)

(AD-A087829) Avail: NTIS HC A08/MF A01 CSCL 12/1

There is a widespread belief among psychologists in the area of applied measurement that Bayesian estimation is better than the maximum likelihood estimation because of the additional information, i.e., prior. For example, many researchers in the computerized adaptive testing use Bayesian methods in the estimation of the examinee's ability. In this paper, this myth is debated theoretically, and in relation with the behavioral reality. Simulation studies are also used to show how biases caused by priors will affect the resultant estimation of the examinee's ability. GRA

N80-32175# Centre National d'Etudes Spatiales, Toulouse (France).

ANALYSIS OF PRINCIPAL COMPONENTS IN THE SEBESTYEN DISCRIMINATION METHOD [ROLE D'ANALYSE EN COMPOSANTES PRINCIPALES DANS LA METHODE DE DISCRIMINATION DE SEBESTYEN]

Jean Pierre Thouvenin Jan. 1980 41 p refs In FRENCH; ENGLISH summary

(CNES-NT-92) Avail: NTIS HC A03/MF A01

Sebestyen's decision - discrimination method based on

principal component analysis is explained. This method is the basis of the data discrimination system for the resonance measurement experiment flown on board the ISEE 1 satellite launched by NASA in October 1977. This pattern recognition problem is fully developed. The optimal number of characteristics needed to describe a data point is determined. The point is represented in N-dimensional space where the different axes correspond to the desired characteristics. The unity of the distance between each point along each axis is then analyzed to determine if it is equal or not to the variance of the characteristic corresponding to that axis. A minimum variance defines the discrimination. Author (ESA)

N80-32176# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL PROPERTIES OF THE DIGITAL SUM IN PARTIAL RESPONSE CODES [PROPRIETA' STATISCHE DELLA SOMMA DIGITALE NEI CODICI PARTIAL-RESPONSE]
Giuseppe Maria Pescatti (Rome Univ.) Mar. 1979 36 p refs In ITALIAN
(FUB-21-1979) Avail: NTIS HC A03/MF A01

A study of the statistical properties of the digital sum in partial response codes is presented with particular reference to the estimation of the variance as a significant parameter for the evaluation of the effect of distortion at low channel frequencies. The problems examined are the computation of the probability distribution and the autocorrelation of the message as a function of the incoming message statistical properties, and the analysis of the transit of a discrete time random process of known statistical characteristics through a linear system with known transfer functions. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-32177 California Univ., Davis.
A STUDY OF NONLINEAR WAVES DESCRIBED BY THE CUBIC SCHRODINGER EQUATION Ph.D. Thesis
Arthur Eugene Walstead 1980 244 p
Avail: Univ. Microfilms Order No. 8019004

A system of quasilinear evolution equations (the modulational equations) were derived for the values of the four parameters of cnoidal waves when they are slowly varying in space and time. The system is subsequently determined to be hyperbolic or elliptic, stable or unstable according to the sign of a certain coefficient pq. Riemann invariants are obtained for several limits for the stable case ($pq < 0$) and growth rates are obtained for several limits, including the solitary wave chain, for the unstable case ($pq > 0$). The dynamics of the cubic Schroedinger equation (CSE) generalized to two spatial dimensions are studied for the case $pq > 0$. A large class of similarity solutions with cylindrical symmetry are obtained systematically using infinitesimal transformation group techniques. The methods are adapted to obtain the symmetries of the action functional of the CSE and to deduce nine integral invariants. A numerical study of the self similar solutions reveals that they are modulationally unstable and that singularities dominate the dynamics of the CSE in two dimensions. The CSE is derived using perturbation theory for a specific problem in plasma physics - the evolution of the envelope of a near monochromatic electromagnetic wave in a cold magnetized plasma. Dissert. Abstr.

N80-32178# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AN APPROXIMATE SOLUTION OF SINGULARLY PERTURBED NON-LINEAR PURSUIT-EVASION GAMES
N. Farber and J. Shinar Feb. 1979 86 p refs
(TAE-359) Avail: NTIS HC A05/MF A01

A methodology to obtain an approximate solution of a singularly perturbed nonlinear differential game is presented. The outcome of the game with approximate strategies, defined as extended value, is related to the saddle point value of the game. In an example of a simple pursuit-evasion game, it is shown that the proposed methodology leads to an easily implementable feedback form solution with fairly accurate results. This approach seems to be attractive to analyze realistic air combat models without solving a two point boundary value problem. Author

N80-31482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATED ANALYSIS OF LARGE SPACE SYSTEMS
Joseph P. Young *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 179-192 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 12B

N80-31483*# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED ANALYSIS CAPABILITY FOR LARGE SPACE SYSTEMS
Robert G. Vos *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 193-202 (For primary document see N80-31449 22-20)
(Contract NAS5-25767)
Avail: NTIS HC A15/MF A01 CSCL 12B

N80-31484*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROLS FOR LSS
Fernando Tolivar *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 203-217 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-32179 North Carolina State Univ., Raleigh.
REPEATABILITY OF SPATIAL CONFIGURATIONS DEFINED BY INTERACTION MATRICES Ph.D. Thesis
Ada Ray Corral 1980 94 p
Avail: Univ. Microfilms Order No. 8020523

The repeatability of the spatial configuration of the location points represented by a vector of estimated interaction effects was studied as a way of determining the impact of random error in the classification of locations according to the genotype by environment interaction. Also the problem of the relative gain or loss of precision in the classification when the dimension of the space of estimated location points is reduced to include only the more important dimensions as reflected in the eigenvalues of the interaction covariance matrix, together with some distributional properties of these eigenvalues are discussed. To do this, a Monte Carlo experiment was carried out using 2000 independent sets of random errors which were used to generate the estimated interaction effects. Different true configurations and different choices of lambda the number of locations, and v, the number of cultivars were used. To measure the degree to which the estimated points reproduced the true points the statistic m to the 2nd power was used; m to the 2nd power is the standardized sum of squared distances between the true location points and the corresponding estimated points after rotation and dilation. Dissert. Abstr.

N80-32180# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
LIMIT CYCLE SOLUTIONS OF REACTION-DIFFUSION EQUATIONS Ph.D. Thesis - Vanderbilt Univ., Aug. 1980
Davis Cope Jun. 1980 330 p refs
(AD-A087114; OEG-PP-287) Avail: NTIS HC A15/MF A01 CSCL 07/4

Contents: Introduction to Reaction-Diffusion Equations; Stability of Limit Cycle Solutions of Reaction-Diffusion Equations; An Analytic Construction for Winfree's Isochrons; Perturbation of the Limit Cycle Solution to Reaction-Diffusion Equations; Numerical Solutions of Reaction-Diffusion Equations; Traveling Waves in Reaction-Diffusion Systems. GRA

N80-32181# Wisconsin Univ. - Madison.
SUBHARMONIC SOLUTIONS OF A FORCED WAVE EQUATION

Paul H. Rabinowitz Nov. 1979 14 p refs
(Contract N00014-76-C-0300)
(AD-A087031) Avail: NTIS HC A02/MF A01 CSCL 12/1

In a recent paper, the existence of subharmonic solutions of forced Hamiltonian systems of ordinary differential equations was established. The goal of this note is to show that subharmonics also occur for a class of semilinear wave equations. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-32182# Technical Training Group (3395th), Keesler AFB, Miss.
THE NATURE OF SCIENCE: A CASE STUDY OF ELECTROMAGNETIC THEORY FROM OERSTED TO HERTZ Final Report
Donald Ralph Baucom 9 Jul. 1979 42 p refs
(AD-A087200) Avail: NTIS HC A03/MF A01 CSCL 20/3

This paper is a case study of the development of a scientific theory, specifically, the development of electromagnetics in the 19th century. After a brief introduction that discusses the nature of science and technology and their interaction in modern research and development, an overview of the science of electricity and magnetism prior to 1800 is presented. Following this introduction, the study focuses on the contributions to the development of electromagnetic theory of four major scientists: Hans Christian Oersted, Michael Faraday, James Clerk Maxwell, and Heinrich Hertz. GRA

N80-32183# Northeastern Univ., Boston, Mass.
HIGH PRESSURE STUDIES TO DETERMINE THE EFFECTS OF VOLUME AND TEMPERATURE ON THE LATTICE DYNAMICS OF MOLECULAR SOLIDS: N2, CO2, CH4 Progress Report, 1 Jul. 1979 - 30 Jun. 1980
F. D. Medina May 1980 7 p refs
(Contract DE-AC02-79ER-10443)
(DOE/ER-10443/1) Avail: NTIS HC A02/MF A01

The temperature dependence of the far infrared spectrum of alpha-N2 was studied for a sample at constant volume. The two modes observed near 50 and 72/cm have frequencies which increase slightly with temperature. The integrated intensity of the mode near 50/cm remains constant with temperature, within experimental uncertainty. The Grueneisen parameter of this mode was estimated to be approximately 3. Two samples of solid CH4 of different densities were grown. Grueneisen parameters of 2.6 and 3.1 were obtained for the librational mode and one translational mode in phase 2. The former indicates an anisotropic intermolecular potential with a strong volume dependence. Changes in the spectrum indicate that the 2 to 3 phase transition involves a sudden, simultaneous tetragonal distortion of the lattice and ordering of the orientationally disordered molecules of phase 2, with a slow reorientation of the ordered molecules. DOE

N80-32184# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
STRUCTURAL ANALYSIS OF SUPERCONDUCTING BENDING MAGNETS
R. B. Meuser May 1980 6 p ref Presented at the 8th Intern. Cryogenic Eng. Conf., Genoa, 3-6 Jun. 1980
(Contract W-7405-eng-48)
(LBL-10950; CONF-800631-3) Avail: NTIS HC A02/MF A01

Mechanical stresses, displacements, and the effects of displacements upon aberrations of the magnetic field in the aperture were calculated for a class of superconducting bending magnet configurations. The analytical model employed for the coil was one in which elements are free to slide without restraint upon each other, and upon the surrounding structure. Coil configurations considered range from an idealized one in which the current density varies as cosine theta to more realistic ones consisting of regions of uniform current density. The results for the more realistic coils closely match those of the cosine theta coil. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-32185 Johns Hopkins Univ., Baltimore, Md.
OPTICAL PROBING OF ACOUSTIC EMISSION DURING DEFORMATION OF MICROTENSILE SPECIMENS Ph.D. Thesis
William James Bruchey 1980 98 p
Avail: Univ. Microfilms Order No. 8020122

Optical interferometric techniques were adapted to detect and analyze acoustic emission signals from 304L stainless steel in order to determine the correlation between fracture surface topography and acoustic emission signals emitted by the material during plastic deformation and failure. A pneumatic load system was developed to accept an optical interferometer as the device for detecting acoustic emission signals. Microtensile specimens were fabricated which limited the zone of deformation to approximately three cubic millimeters in volume. Use of the optical probe permitted the monitoring of transient surface displacements to within fractures of a millimeter of the deforming volume. Results demonstrate that acoustic emission is a volume phenomena. For the small plastic zone size investigated, the acoustic emission counts have been minimized to the extent that signals are spatially separated in time and waveform analysis can be conducted on each of the signals. Test results show that existing models describing dislocations as the source of acoustic emission are not sufficient to describe the observed behavior. Dissert. Abstr.

N80-32186*# Lockheed-Georgia Co., Marietta.
A STUDY OF THE TRANSMISSION CHARACTERISTICS OF SUPPRESSOR NOZZLES
K. K. Ahuja, M. Salikuddin, R. H. Burrin, and H. E. Plumbee, Jr.
Jun. 1980 263 p refs
(Contract NAS3-20797)
(NASA-CR-165133) Avail: NTIS HC A12/MF A01 CSCL 20A

The internal noise radiation characteristics for a single stream 12 lobe 24 tube suppressor nozzle, and for a dual stream 36 chute suppressor nozzle were investigated. An equivalent single round conical nozzle and an equivalent coannular nozzle system were also tested to provide a reference for the two suppressors. The technique utilized a high voltage spark discharge as a noise source within the test duct which permitted separation of the incident, reflected and transmitted signals in the time domain. These signals were then Fourier transformed to obtain the nozzle transmission coefficient and the power transfer function. These transmission parameters for the 12 lobe, 24 tube suppressor nozzle and the reference conical nozzle are presented as a function of jet Mach number, duct Mach number polar angle and temperature. Effects of simulated forward flight are also considered for this nozzle. For the dual stream, 36 chute suppressor, the transmission parameters are presented as a function of velocity ratios and temperature ratios. Possible data for the equivalent coaxial nozzle is also presented. Jet noise suppression by these nozzles is also discussed. A.R.H.

N80-32187*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE INFLUENCE OF WALL RESONANCES ON THE LEVITATION OF OBJECTS IN A SINGLE-AXIS ACOUSTIC PROCESSING CHAMBER
Bruce B. Ross Sep. 1980 11 p refs
(NASA-TM-78299) Avail: NTIS HC A02/MF A01 CSCL 20A

Instabilities were observed in high temperature, single axis acoustic processing chambers. At certain temperatures, strong wall resonances were generated within the processing chamber itself and these transverse resonances were thought sufficient to disrupt the levitation well. These wall resonances are apparently not strong enough to cause instabilities in the levitation well. T.M.

N80-32188*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL INVESTIGATION OF THE RADIATION OF SOUND FROM AN UNFLANGED DUCT AND A BELL-MOUTH, INCLUDING THE FLOW EFFECT
Jean-Michel Ville (George Washington Univ.) and Richard J. Silcox Aug. 1980 65 p refs
(NASA-TP-1697; L-13252) Avail: NTIS HC A04/MF A01 CSCL 20A

The radiation of sound from an inlet as a function of flow velocity, frequency, duct mode structure, and inlet geometry was examined by using a spinning mode synthesizer to insure a given space-time structure inside the duct. Measurements of the radiation pattern (amplitude and phase) and of the pressure reflection coefficient were obtained over an azimuthal wave number range of 0 to 6 and a frequency range up to 5000 Hz for an unflanged duct and a bellmouth. The measured radiated field and pressure reflection coefficient without flow for the unflanged duct agree reasonably well with theory. The influence of the inlet contour appears to be very drastic near the cut-on frequency of a mode and reasonable agreement is found between the bellmouth pressure reflection coefficient and a infinite hyperboloidal inlet theory. It is also shown that the flow has a weak effect on the amplitude of the directivity factor but significantly shifts the directivity factor phase. The influence of the flow on the modulus of the pressure reflection coefficient is found to be well described by a theoretical prediction. M.G.

N80-32189# Utah Univ., Salt Lake City. Dept. of Mathematics.
SPECTRAL ANALYSIS OF SOUND PROPAGATION IN STRATIFIED FLUIDS Technical Summary Report
Calvin H. Wilcox Apr. 1980 154 p refs
(Contract N00014-76-C-0276; NR Proj. 041-370)
(AD-A087735; TSR-38) Avail: NTIS HC A08/MF A01 CSCL 20/1

This paper presents a spectral analysis of the acoustic fields in stationary plane stratified fluids whose densities and sound speeds are functions of the depth. The analysis is based on families of normal mode fields that have simple physical interpretations. The acoustic field in such a fluid may be described by an acoustic potential or by the excess pressure. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-32190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATOMIC EMISSION LINES IN THE NEAR ULTRAVIOLET: HYDROGEN THROUGH KRYPTON, SECTION 1
Raymond L. Kelly Apr. 1979 403 p
(NASA-TM-80268-Sect-1) Avail: NTIS HC A08/MF A01 CSCL 20H

A compilation of spectra from the first 36 elements was prepared from published literature available through October 1977. In most cases, only those lines which were actually observed in emission or absorption are listed. The wavelengths included range from 2000 Angstroms to 3200 Angstroms with some additional lines up to 3500 Angstroms. Only lines of stripped atoms are reported; no molecular bands are included. L.F.M.

N80-32191*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATOMIC EMISSION LINES IN THE NEAR ULTRAVIOLET: HYDROGEN THROUGH KRYPTON, SECTION 2
Raymond L. Kelly Apr. 1979 384 p
(NASA-TM-80268-Sect-2) Avail: NTIS HC A17/MF A01 CSCL 20H

A compilation of spectra from the first 36 elements was prepared from published literature available through October 1977. In most cases, only those lines which were actually observed in emission or absorption are listed. The wavelengths included range from 2000 Angstroms to 3200 Angstroms with some additional lines up to 3500 Angstroms. Only lines of stripped atoms are reported; no molecular bands are included. L.F.M.

N80-32192# IRT Corp., San Diego, Calif.
INVESTIGATION OF ELECTRON ATTACHMENT IN POLYATOMIC MOLECULES Final Report, 1 Apr. 1977 - 31 Mar. 1980
Jerry T. Dowell 30 May 1980 62 p refs
(Contract F49620-77-C-0071; AF Proj. 2303)
(AD-A087278; IRT-8164-004; AFOSR-80-0549TR) Avail: NTIS HC A04/MF A01 CSCL 20/7

Electron attachment to polyatomic molecules was studied using molecular beams of variable temperature crossed with an electron of high energy resolution. Species investigated include sulfur hexafluoride, molybdenum hexafluoride, and tungsten oxide polymers. New results were obtained in sulfur hexafluoride demonstrating importance of internal energy for the dissociative attachment in molybdenum hexafluoride. Tungsten oxide vapor exhibits both monomer and dimer negative ion formation near zero energy, apparently from dissociative attachment to the trimer. GRA

N80-32193# Stanford Univ., Calif. Edward L. Ginzton Lab.
RESEARCH STUDIES ON RADIATIVE COLLISIONAL PROCESSES Interim Technical Report
S. E. Harris and J. F. Young Jun. 1980 36 p
(Contract F49620-80-C-0023)
(AD-A087527; SU-GL-3147; ARO-16996.1-P) Avail: NTIS HC A03/MF A01 CSCL 20/8

A radiative collisional process is one wherein two atoms and a photon simultaneously participate. In the prototype reaction, energy is first stored in a state of some atom and an incident laser is tuned so as to satisfy the energy defect between this storage state and a selected state of a second atom. In the presence of this incident laser beam, the collision cross section may be as large as 10 to the minus 12th sq cm (i.e., corresponding to billiard ball sizes of the atoms of almost 100 A), thereby allowing rapid transfer of energy to the target species. Of particular interest, the storage species may not only be an excited state of an atom, but instead may also be the ground state of an ion. An intense laser field may then be used to rapidly transfer this energy to an excited ionic state of a second species. Such a process is termed as laser induced charge transfer. Since ground state ions are easily created and represent a means of longlived energy storage, laser induced charge transfer processes are particularly exciting for applications. GRA

N80-32194# New York Univ., N. Y. Dept. of Physics.
ENERGY-RELATED ATOMIC AND MOLECULAR STRUCTURE AND SCATTERING STUDIES Annual Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Benjamin Bederson Mar. 1980 39 p refs
(Contract ER-78-S-02-4971)
(DOE/ER-04971/2) Avail: NTIS HC A03/MF A01

Measurements of polarizabilities of highly polar molecules and dimers, and of a number of atoms distributed through the periodic table, and, of the scattering of low energy electrons by highly polar molecules were made. For this latter series of measurements, an entirely new apparatus was designed and its external components were completed. A new electron optics assembly was also designed. Details of these projects are presented; analysis and data of the polarizability measurements are also given. DOE

N80-32195# Oregon Univ., Eugene. Inst. of Theoretical Science.
ATOMIC SCALE RESOLUTION WITH CORRELATION HOLOGRAPHY
Paul L. Csonka 1979 8 p
(Contract EY-76-S-06-2230)
(DOE/ER-70004/260) Avail: NTIS HC A02/MF A01

Observation of small objects was made. Observations were compatible with the principles of quantum mechanics, even when the probability of disturbing the object as a result of observation was arbitrarily small. DOE

N80-32196# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

MEASUREMENTS OF ELECTRONIC STIMULATION OF ATOMS IN COLLISIONS WITH ATOMS AND MOLECULES NEAR THE THRESHOLD [MESSUNG DER ELEKTRONISCHEN ANREGUNG VON ATOMEN IN STOSS MIT ATOMEN UND MOLEKUELEN IN SCHWELLENNAEHE]
Detlev Pust Jun. 1979 82 p refs In GERMAN
(MPIS-14/1979) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 15,30

The seeded beam experiment is described. The stimulation of Xe in collisions with Xe is measured. The experimental results confirm the theoretical calculation. Author (ESA)

NBO-32197# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
CRITERIA FOR DATA ELABORATION OF GAMMA SPECTRA OF AMBIENT SAMPLES [CRITERI DI ELABORAZIONE DI SPETTRI GAMMA DI CAMPIONI AMBIENTALI]
A. L. Traversi Nov. 1979 10 p refs In ITALIAN Presented at 21st AIPR Congr., Palermo, Italy, 16-19 Oct. 1979
(CISE-1536) Avail: NTIS HC A02/MF A01

An analysis of low frequency count gamma spectra data processing, from ambient samples measured with Ge(Li) detectors is presented. Some concepts are examined, such as peak significance and minimum detectable count for a given background. Solutions are suggested for the determination of the peak area, for the computation of the confidence interval and for transformation of counts in concentration (pCi/kg). A model is proposed for the evaluation of the efficiency curve as a function of the energy based on polynomial regression techniques. Author (ESA)

NBO-32198# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
FIELD GAMMA SPECTROMETRY SYSTEM WITH Ge(Li) DETECTORS [SISTEMA PER SPETTROMETRIA GAMMA IN CAMPO CON RIVELATORE A Ge(Li)]
N. DePasquale and R. Dugnani Lonati Nov. 1979 10 p refs In ITALIAN Presented at 21st AIPR Congr., Palermo, Italy, 16-19 Oct. 1979
(CISE-1537) Avail: NTIS HC A02/MF A01

The design and means of adjustment of a field gamma spectrometry system is described. The system uses position adjustable Ge(Li) detectors and a portable ionization camera. The detector resolution is high enough to discriminate the relative contribution to the total dose measured by the camera of several sources such as artificial radioactive nuclei, the gamma emmiters produced by natural series decay, and potassium 40.
Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

NBO-32199# Naval Research Lab., Washington, D. C.
COLLECTIVE ACCELERATION OF ELECTRONS USING AUTOACCELERATION PROCESSES
Thomas R. Lockner and Mashe Friedman Jul. 1980 32 p refs
(ARPA Order 3718)
(AD-A087001; AD-E000494; NRL-MR-4256) Avail: NTIS HC A03/MF A01 CSCL 20/7

A means of collectively accelerating an intense electron beam is demonstrated. A long pulse (800 ns) electron beam is propagated through cavity structures which redistributed the energy in the beam such that most of the beam energy is transferred to a short segment (6 nsec) in the tail of the bram; electrons are accelerated in a two cavity system from 200 KeV to energies of 2.4 - 3.0 MeV at a beam current of approximately 8 kA. The extension of this principle to larger number of cavities appears feasible. GRA

NBO-32200# Battelle Pacific Northwest Labs., Richland, Wash.
CRITICALITY SAFETY CONSIDERATIONS IN THE GEOLOGIC DISPOSAL OF SPENT NUCLEAR FUEL ASSEMBLIES
B. F. Gore, G. W. McNair, and S. W. Hesberlin May 1980 53 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3268) Avail: NTIS HC A04/MF A01

Features of geologic disposal which hamper the demonstration that criticality cannot occur therein include possible changes of shape and form, intrusion of water as a neutron moderator, and selective leaching of spent fuel constituents. If the criticality safety of spent fuels disposal depends on burnup, independent measurements verifying the burnup should be performed prior to disposal. The status of nondestructive analysis method which might provide such verification is discussed. Calculations were performed to assess the potential for increasing the allowed size of a spent fuel disposal canister if potential water intrusion were limited by close packing the enclosed rods. Several factors were identified which severely limited the potential of this application. The theoretical limit of hexagonal close packing cannot be achieved due to fuel rod bowing. It is concluded the disposal canisters should be sized on the basis of assumed optimum moderation. DOE

NBO-32201# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
SMALL-SCALE DEMONSTRATION OF HIGH-LEVEL RADIOACTIVE WASTE PROCESSING AND SOLIDIFICATION USING ACTUAL SRP WASTE
J. K. Okeson, R. M. Galloway, E. L. Wilhite, G. B. Woolsey, and R. B. Ferguson 1980 33 p refs Presented at the AIChE 89th Natl. Meeting, Portland, Oreg., 17-20 Aug. 1980
(Contract DE-AC09-76SR-00001)
(DP-MS-80-2; CONF-800802-2) Avail: NTIS HC A03/MF A01

A small scale demonstration of the high-level radioactive waste solidification process by vitrification in borosilicate glass was conducted using 5-6 liter batches of actual waste. Equipment performance and processing characteristics of the various unit operations in the process are reported and, where appropriate, are compared to large-scale results obtained with synthetic waste. DOE

NBO-32202# Atomics International Div., Richland, Wash. Engineered Barriers Group.
FUNCTIONS OF AN ENGINEERED BARRIER SYSTEM FOR A NUCLEAR WASTE REPOSITORY IN BASALT
W. E. Coons, E. L. Moore, M. J. Smith, and J. D. Kaser Jan. 1980 35 p refs
(Contract DE-AC06-77RL-01030)
(RHO-BWI-LD-23) Avail: NTIS HC A03/MF A01

The functions of components selected for an engineered barrier system for a nuclear waste repository in basalt are defined providing a focal point for barrier material research and development by delineating the purpose and operative lifetime of each component of the engineered system. A five component system (comprised of waste form, canister, buffer, overpack, and tailored backfill) is discussed. Redundancy is provided by subsystems of physical and chemical barriers which act in concert with the geology to provide a formidable barrier to transport of hazardous materials to the biosphere. The barrier system is clarified by examples pertinent to storage in basalt, and a technical approach to barrier design and material selection is proposed. DOE

NBO-32203# Union Carbide Corp., Oak Ridge, Tenn.
ASSUMPTIONS AND GROUND RULES USED IN NUCLEAR WASTE PROJECTIONS AND SOURCE TERM DATA
S. N. Storch and B. E. Prince Sep. 1979 137 p
(Contracts W-7405-eng-26; DE-AC06-76PL-01830)
(ONWI-24) Avail: NTIS HC A07/MF A01

Assumptions and ground rules of long term domestic commercial nuclear waste projections published by two sources are compared. Target capacity growths associated with these projections range from 183 to 570 GW(e) for the year 2000. Each study regards the once through (no recycle) fuel cycle as a reference case. Fuel cycles employing reprocessing and various recycle strategies were also considered. The studies are compared with respect to characteristics and packaging/shipment features of spent fuel and wastes generated from reprocessing and other fuel cycle activities. Issues associated with the interim storage

of spent fuel are discussed along with the characteristics and issues relating to ore mill tailings and non-fuel cycle wastes. Assumptions and limitations associated with certain computer codes (viz., ORIGEN, KWIKPLAN, WASPR, and DISFUL) employed in the four waste projection studies are also outlined. DOE

N80-32204# Geological Survey, Denver, Colo.
RESISTIVITY SOUNDING INVESTIGATION BY THE SCHUMBERGER METHOD IN THE SYNCLINE RIDGE AREA, NEVADA TEST SITE, NEVADA
L. A. Anderson, R. J. Bisdorf, and D. R. Schoenthaler 1980 67 p refs
(Contract EW-78-A-08-1543)
(USGS-OFR-80-466) Avail: NTIS HC A04/MF A01

A resistivity survey was made in the north central sector of the Nevada Test Site as part of an extensive search for suitable geologic environments to be used as repositories for radioactive waste products. The surficial geology, mapped and inferred faults, resistivity sounding sites, borehole emplacements, and alinements of resistivity cross sections compiled from the interpreted sounding data are included. DOE

N80-32205# Rockwell International Corp., Richland, Wash. Hanford Operations.
TECHNICAL PROGRAM PLAN, BASALT WASTE ISOLATION PROJECT
Dec. 1979 128 p
(Contract DE-AC06-77RL-01030)
(RHO-CD-132-Rev-5) Avail: NTIS HC A07/MF A01

The Basalt Waste Isolation Project program objectives, scope and scientific technologies are discussed. The work breakdown structure of the project includes: project management and support, systems integration, geosciences, hydrology, engineered barriers, test facility design and construction, engineering testing, repository studies, and schedules. Author (DOE)

N80-32206# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
SYSTEMATIC APPROACH FOR ASSESSMENT OF ALTERNATIVE NUCLEAR WASTE MANAGEMENT STRATEGIES
Gour-Tsyh Yeh 1979 8 p refs Presented at the Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791112-66) Avail: NTIS HC A02/MF A01

The fate and transport of radwaste in the environment and to man was evaluated using system of flow dynamic and waste transport models for the physical environment, transfer models to biota, and dose models to man. Flow dynamic and waste transport models are included for computing spatial temporal variations of the flow field and radwaste concentration in subsurface aquifers, surface water regimes, estuaries/oceans, and the atmosphere. Transfer models are linked to flow dynamic and waste transport models to study the uptake from and to the physical environment of the waste by aquatic and terrestrial biota. Dose models are used to compute both the radwaste input to man and its effect on man. With these series of computations, the radiation dose from alternative nuclear waste management strategies can be computed. Coupled with the exposure and effect analysis, the approach should facilitate the selection of the best management methodologies among many alternatives. DOE

N80-32207# Oak Ridge National Lab., Tenn.
STATISTICAL SENSITIVITY ANALYSIS OF A SIMPLE NUCLEAR WASTE REPOSITORY MODEL
Y. Ronen, J. L. Lucius, and E. M. Blow Jun. 1980 75 p
(Contract W-7405-eng-26)
(ORNL/TM-7310) Avail: NTIS HC A04/MF A01

A preliminary step in a comprehensive sensitivity analysis of the modeling of a nuclear waste repository. The purpose of the complete analysis is to determine which modeling parameters and physical data are most important in determining key design performance criteria and then to obtain the uncertainty in the design for safety considerations. The theory for a statistical screening design methodology is developed for later use in the overall program. The theory was applied to the test case of determining the relative importance of the sensitivity of near field temperature distribution in a single level salt repository to modeling parameters. The exact values of the sensitivities to these physical and modeling parameters were then obtained using direct methods of recalculation. The sensitivity coefficients found to be important for the sample problem were thermal loading, distance between the spent fuel canisters and their radius. Other important parameters were those related to salt properties at a point of interest in the repository. DOE

74 OPTICS

Includes light phenomena.

N80-32208*# Visidyne, Inc., Burlington, Mass.
PINHOLE X-RAY/CORONAGRAPH OPTICAL SYSTEMS CONCEPT DEFINITION STUDY Final Report
T. F. Zehnpfenning, S. A. Rappaport, and R. B. Wattson 12 Sep. 1980 81 p
(Contract NAS8-33697)
(NASA-CR-161567; VI-556) Avail: NTIS HC A05/MF A01 CSCL 20F

The Pinhole X-ray/Coronagraph Concept utilizes the long baselines possible in Earth orbit with the space transportation system (shuttle) to produce observations of solar X-ray emission features at extremely high spatial resolution (up to 0.1 arc second) and high energy (up to 100 keV), and also white light and UV observations of the inner and outer corona at high spatial and/or spectral resolution. An examination of various aspects of a preliminary version of the X-ray Pinhole/Coronagraph Concept is presented. For this preliminary version, the instrument package will be carried in the shuttle bay on a mounting platform, and will be connected to the occulter with a deployable boom such as an Astromast. Generally, the spatial resolution, stray light levels, and minimum limb observing angles improve as the boom length increases. However, the associated engineering problems also become more serious with greater boom lengths. T.M.

N80-32209# Electronics Research Lab., Adelaide (Australia).
APPLICATION OF INTERFRAME FILTERING TO LINE SCANNED INFRARED IMAGING SYSTEMS
G. V. Poropat Nov. 1979 22 p refs
(AD-A086971; ERL-0112-TM; AR-001-827) Avail: NTIS HC A02/MF A01 CSCL 17/5

The use of frame storage in an imaging system to implement interframe filtering is analyzed and its effects on image signal to noise ratio determined. Simulation of interframe processing on imagery obtained using an AGA Thermovision is described. The application of interframe filtering to real time imaging systems is examined. GRA

N80-32210# Harry Diamond Labs., Adelphi, Md.
A VERSATILE FIBER-OPTICS SIGNAL LINK FOR EMP TESTING AND GENERAL LABORATORY APPLICATIONS Technical Memorandum, Jul. 1977 - Jul. 1978
James C. Blackburn and Robert Martin Jun. 1980 26 p refs
(AD-A087253; HDL-TM-80-5) Avail: NTIS HC A03/MF A01 CSCL 20/6

A fiber-optic analog signal link is described that was designed specifically to be used for EMP measurements. The link accepts electrical inputs in the range from millivolts to volts and converts them to optical signals which are then transmitted by optical fibers to a remote receiver. The unit is unaffected by electric fields up to hundreds of kilovolts/meter, and a bandwidth of about 130 MHz is provided; the unit has a dynamic range of approximately 30 dB. This dynamic range is extended an additional 45 dB by an internal attenuator which is commanded (by an optical fiber link) to insert a fixed attenuation in the range of 0 to 45 dB between the input connecter and transmitter. A self-calibrator is also commanded by the same link. An unusual circuit feature is the use of a single electro-optic device to perform both light-emitting diode and detector functions. GRA

N80-32211# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
SENSITIVE MEASUREMENT OF PHOTON LIFETIME AND TRUE REFLECTANCES IN AN OPTICAL CAVITY BY A

PHASE SHIFT METHOD
J. M. Herbelin, J. A. McKay, M. A. Kwok, R. H. Ueunten, and D. S. Urevig 10 Jul. 1980 23 p refs
(Contract F04701-79-C-0080)
(AD-A087248; TR-0080-5610-2; SDTR-80-48) Avail: NTIS HC A02/MF A01 CSCL 20/6

A simplified method for measuring the effective photon lifetime in an optical resonator was developed. The technique requires the passage of a modulated continuous wave laser beam through the resonator and the measurement of the resultant shift in the phase of the transmitted intensity. The method not only permits a quick and precise measurement of the mirror reflectances, but also permits these measurements to be in situ. Such an 'on the spot' evaluation capability should be extremely useful in applications ranging from the investigation of new laser systems to the development of improved optical coatings. The method is also sensitive to the effects of absorption, scattering, and transmission from elements in the cavity. Cavity losses smaller than 100 ppm were detected. GRA

N80-32212# Naval Research Lab., Washington, D. C. Optical Sciences Div.
TRANSMITTANCE MEASUREMENTS AT DIRT-II Final Report
Joseph A. Curcio, Kenneth M. Haught, and Michael A. Woytko 10 Jul. 1980 53 p ref
(AD-A087003; AD-E000484; NRL-MR-4260) Avail: NTIS HC A04/MF A01 CSCL 20/6

This is a report on the NRL experiments at the DIRT-II tests sponsored by the Atmospheric Sciences Laboratory at the White Sands Missile Range in July 1970. The NRL experiment was designed to measure spectral transmittance through smoke and dust clouds generated by detonations of various explosive charges and also by impact of artillery rounds. Spectral transmission data as a function of time for 0.55 micrometers, 1.06 micrometers, and 10.37 micrometers were obtained for 63 events comprised of static detonations and artillery rounds. Transmission data for 1.06 micrometers, in most cases were similar and equal to 0.55 micrometers. In dry soil conditions the 10.37 micrometers channel showed higher transmittance values than the visible channel. There are indications that 10.37 micrometers transmittance in wet soil events is lower than visible presumably because of strong liquid water absorption at the IR wavelength. GRA

N80-32213# University of Southern California, Los Angeles.
RAMAN-INDUCED KERR EFFECT STUDIES Final Report, 15 Jul. 1976 - 14 Jul. 1979
Robert W. Hellwarth 10 Jun. 1980 14 p refs
(Grant DAAG29-76-G-0295; DA Proj. 1T1-61102-BH-57)
(AD-A087410; ARO-14188.1-P) Avail: NTIS HC A02/MF A01 CSCL 20/6

The Raman-Induced Kerr Effect, developed at U.S.C. is a new form of laser spectroscopy which is beginning to find wide application as a remote diagnostic sensor of fast (picosecond to nanosecond) transient shocks, explosions, and plasma arcs. GRA

N80-32214# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
ON THE FEASIBILITY OF USING FLIR (FORWARD LOOKING INFRARED) DATA FOR CROSSWIND MEASUREMENTS
G. R. Ochs, S. F. Clifford, and Ting-i Wang White Sands Missile Range, N. Mex. Atmospheric Sciences Lab. Jun. 1980 46 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A087738; ERADCOM/ASL-CR-80-8003-1) Avail: NTIS HC A03/MF A01 CSCL 17/5

The feasibility was theoretically examined and experimentally tested for extracting crosswind information from a forward looking infrared thermal sight system (FLIR). A general solution to the problem of obtaining crosswind information from the observation of focal plane image fluctuations is obtained. Wind weighting functions are obtained for receiving apertures and detector sizes of interest for the particular case of viewing the horizon. Experimental results are presented from measurements at visible wavelengths using stationary detectors placed in the focal plane, and also from the recorded video signals obtained directly from the FLIR. These results show that under controlled conditions with a suitable scene and C sub n to the 2nd power level it is possible to obtain crosswind information from the FLIR system. GRA

N80-32215# Harry Diamond Labs., Adelphi, Md.
THE LSR/2 OPTICALLY COUPLED SIGNAL TRANSMISSION LINK Technical Memorandum, Jul. 1978 - Mar. 1979
James C. Blackburn Dec. 1979 25 p refs
(AD-A087552; HDL-TM-79-24) Avail: NTIS HC A02/MF A01 CSCL 17/2

The design is presented for a fiber optic transmission system intended for carrying analog instrumentation signals over a 1 km length of single fiber. The bandwidth (+ or - 3 dB) is 5 kHz to 220 MHz with a dynamic range of approx. 35 dB. Special attention is given to minimizing the modal noise produced by the single mode laser source. GRA

N80-32216# General Electric Co., Utica, N. Y. Aerospace Electronic Systems Dept.
COMMON APERTURE TECHNIQUES FOR IMAGING ELECTRO-OPTICAL SENSORS Final Report, Jul. 1976 - Nov. 1979
Wright-Patterson AFB, Ohio Air Force Wright Aeronautical Labs. Feb. 1980 305 p
(Contract F33615-76-C-1135; AF Proj. 2004)
(AD-A087558; Rept-79-556-C0-10; AFWAL-TR-80-1012) Avail: NTIS HC A14/MF A01 CSCL 20/6

A multispectral optical imaging system was designed and fabricated to demonstrate the feasibility of utilizing a pointable common optical aperture in conjunction with interchangeable day or night TV sensors and a thermal imaging sensor. Limited processing capability was incorporated to permit mixing of both visible and infrared video of common scenes for more effective all weather electrooptical capability. An optical configuration was established which will accommodate image sensors as well as illuminating and designating/ranging lasers. In the early phases of the program various techniques were evaluated for optimizing spectral separation, gating image intensifiers and minimizing degradation of sensor performance due to insertion of .723 and 1.06 micron laser radiation through the common aperture. Preliminary testing indicates that combining sensors achieves synergistic performance in targeting and identification. Edited monthly R D Status Reports detail the design, fabrication and integration aspects of the program. GRA

N80-32217# ITT Electro-Optical Products Div., Roanoke, Va.
ULTRA LOW OPTICAL FIBER CABLE ASSEMBLIES Semiannual Report, 1 Dec. 1978 - 31 Jul. 1979
J. C. Smith, R. Kopstein, and X. G. Glavas Fort Monmouth, N.J. Army Communication Research and Development Command May 1980 97 p
(Contract DAAB07-78-C-2922)
(AD-A087517; CORADCOM-78-2922-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

Progress toward development of ruggedized ultra low loss 8.0 D B/KM optical fiber cable assemblies consisting of six optical fibers is reported. Effort involves investigations of fiber, cabling, and connector development on an individual as well as combined basis for meeting requirements of tactical TDM communication systems. During this reporting period, extensive testing and evaluation of three six fiber cables was performed in accordance with technical guidelines. Pertinent test results are summarized herein. Complete test data is reported elsewhere. Program areas requiring additional investigation are described. Development status of two types of connectors is discussed and preliminary test data presented. Difficulties incurred with fiber connector interface are identified. GRA

N80-32218# RCA Labs., Princeton, N. J. Energy Systems Research Lab.
LAMINATED FRESNEL LENSES
Robert W. Jebens Apr. 1980 27 p
(Contract DE-AC04-76DP-00789)
(SAND-80-7007) Avail: NTIS HC A03/MF A01

A fabrication method for making plastic on glass laminated Fresnel lenses is discussed. These Fresnel lenses are for application in a solar photovoltaic concentrator array. This laminated Fresnel lens fabrication method consists of making a silastic rubber mold

of a master lens array. Cast acrylic Fresnel lens arrays commercially available have potential cleaning and abrasion problems, have very large thermal expansion, and have dimensional uncertainties in their manufacture. The laminated lens is dimensionally stable with low thermal expansion, has good cleaning characteristics, and is very inexpensive in materials cost. The measured transmission of such a lens on low iron glass is 80.4 percent compared with 85.1 percent for a cast acrylic lens, and the optical quality is good enough for application in the 100X to 200X concentration range. An approach to making large lens arrays (3 by 6 ft) on a commercial scale is explored. DOE

N80-32219# Fondazione Ugo Bordoni, Rome (Italy).
MEASUREMENT OF THE INDEX PROFILE OF OPTICAL FIBERS BY THE REFRACTION METHOD [LA MISURA DEL PROFILO D'INDICE DI FIBRE OTTICHE CON IL METODO DI RIFRAZIONE]
Ludovico Muzii Jul. 1979 24 p refs In ITALIAN
(FUB-13-1979) Avail: NTIS HC A02/MF A01

A device to measure the functional characteristics of optical fibers by the refracted near field method is described. The basic theory is reviewed and experimental results presented. The optical system using a 6300 A laser source and the measuring procedure are detailed. Errors are + or - 1 micron for the diameter, + or - 0.005 for the aperture, and + or - 0.1 for the alpha exponent. The effect of anomalous profiles on the measured results are discussed. Author (ESA)

N80-32220# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
LASER DOPPLER VELOCIMETRY: PRINCIPLES, POTENTIAL AND EXAMPLES OF POSSIBLE APPLICATIONS
M. L. Riethmuller Feb. 1979 9 p refs Presented at Neth. Soc. for Photonics Conf. on Properties and Appl. of Laser Radiation II, Delft, 18-20 Apr. 1979 Submitted for publication
(VKI-PREPRINT-1979-6) Avail: NTIS HC A02/MF A01

The working principles and applications examples of the laser Doppler velocimeter are presented. Advanced systems permitting multidimensional simultaneous measurement are mentioned. The examples presented include supersonic flow measurements, free surface velocity measurement in rheological flows, and velocity profile measurements inside the gelatin layer of a photosensitive film. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-32221 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL INVESTIGATION OF THE TRAPPING AND ENERGY LOSS MECHANISMS OF INTENSE RELATIVISTIC ELECTRON RINGS IN HYDROGEN GAS AND PLASMA Ph.D. Thesis
Adrain Charles Smith, Jr. 1977 677 p
Avail: Univ. Microfilms Order No. 8020918

Gas trapping, average ring electron energetic, plasma trapping, and hollow beam cusp injection into gas and plasma were investigated using the Cornell RECE-Berta facility. Data from an axial array of magnetic probes were compared with findings from a high energy electron current monitor to show that the trapping proceeds as a relaxation process in which an initially uniform, circulating sheath of current collapses axially in 300-500 ns to form a steady state ring. Multifoil X-ray absorption spectroscopy was used to analyze the Bremsstrahlung generated by the electrons as they impinge upon a thin tungsten wire target suspended in the circulating current. Results show that the particle energy loss rates were constant functions of time and that, typically, net energy losses of about 10 percent of the initial ring energy (500 keV) were sustained by the electrons during their residence in the mirror trap. The results of electron ring trapping and confinement in neutral gas were extended to studying these processes in a preionized plasma. A set of preliminary experimental results are presented in which an annular electron beam was passed through a coaxial, non adiabatic magnetic cusp located at one end of the magnetic mirror well.
Dissert. Abstr.

N80-32222 Lehigh Univ., Bethlehem, Pa.
STARK PROFILE MEASUREMENT OF Cu REVERSAL LINES IN A DENSE PLASMA Ph.D. Thesis
Peter Scott Sincerny 1980 135 p
Avail: Univ. Microfilms Order No. 8019727

A dense plasma was produced between two copper electrodes by ionizing high pressure (850 atm) hydrogen gas with a short electrical discharge pulse. A full set of diagnostic experiment was performed to quantitatively measure the plasma evolution. The profiles of two self reversal copper resonance lines were measured as a function of the ambient hydrogen gas pressure. These lines appear at 3247 A and 3274 A. The full half width of the two lines is found to range from 52 A to 67 A. Two computer simulation codes were developed to provide quantitative details of the plasma source. The electron density responsible for the broadening of the spectral lines was determined by analyzing the results of the numerical simulations. The region of the plasma controlling the observed line profile was identified by successfully reproducing the observed line profiles on the basis of the simulation results and with an assumed line shape. The usefulness of the observed reversal line profiles for comparison with Stark theory is limited due to the superposition of the copper lines at the high electron density, thus making individual analysis difficult. Dissert. Abstr.

N80-32223*# Colorado State Univ., Fort Collins. Dept. of Physics.
INTERACTION OF HIGH VOLTAGE SURFACES WITH THE SPACE PLASMA Annual Report
Harold R. Kaufman and Raymond S. Robinson May 1980 50 p refs
(Grant NsG-3198)
(NASA-CR-165131) Avail: NTIS HC A03/MF A01 CSCL 20I

High voltage solar arrays provide spacecraft power while optimizing mass and power efficiency. Operating such arrays in the space plasma environment can result in anomalously large currents being collected through insulation defects. Two thicknesses of the insulating material were tested, with no effect found due to insulator thickness. In these tests the polyimide thickness was always much less than the pinhole diameter. The pinhole area was varied over an area range of more than 30:1. It was found that the current collected was independent of the pinhole area for hole diameters from 0.35 to 2.0 mm. Two types of adhesives were tried in two different configurations. The adhesives were chosen for their extreme difference in vacuum qualifications. Neither adhesive types nor configuration made a significant difference in current collection. The temperature of the insulating material was also varied. It was found that current collection decreased with increasing temperature. Tests were conducted to see if pinhole current collection decreased with time, as was indicated by the effects of several short tests. Current was collected for over four hours while the conductor potential was held constant at 1000 volts. A smooth decrease with time was not observed, but rather a roughly constant current collection with brief surges to high values. Tests were also conducted with the simulated solar cell biased negative. The current was found to be proportional to pinhole area. R.K.G.

N80-32224# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A MEASUREMENT OF DEUTERIUM NEUTRAL BY THE BALMER-SERIES IN THE STP-2 HIGH BETA SCREW PINCH TOKAMAK
S. Yamaguchi and K. Hirano Jun. 1980 23 p refs
(IPPJ-471) Avail: NTIS HC A02/MF A01

The Balmer-alpha and beta are measured with a calibrated spectrograph in STP-2 screw pinch Tokamak operated under the maximum toroidal field being 9.2 kg, peak plasma current 30 kA and filling pressure 5 mtorr. The electron temperature and density profiles are obtained by ruby laser Thomson scattering. It is shown that electron temperature is about 10 eV and density is of the order 10 to the 14th power cu cm. A non-cylindrical symmetric Abel-inversion technique was used to deduce the emission coefficient profiles from that of the line intensity of the Balmer's. The collisional radiative model is applied to the

rate equations to estimate the ground state population density. It is found that at 4 micron sec from the start of the discharge the deuterium neutral density may be approximately 2 x10 to the 12th power cu cm at the center of plasma and 2 x 10 to the 14th power cu cm at the periphery. These values may contain an error of about factor two. Time history of neutral deuterium density is consistent with the increase of plasma density. A.R.H.

N80-32226# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRELIMINARY EXPERIMENT OF NEUTRAL BEAM INJECTION HEATING IN JIPP T-2 STELLARATOR
O. Kaneko, Y. Oka, H. Okamura, T. Kunibe, and T. Kuroda Jun. 1980 25 p refs
(IPPJ-470) Avail: NTIS HC A02/MF A01

Neutral beam injection experiments are carried out in JIPP T-2, which is a hybrid device of stellarator and Tokamak. Two neutral beam injectors are equipped tangentially in the direction of co- and counter-injections. Hydrogen neutral beams of 22 Kev, 60 KW (co-injection) and 30 KW (counter-injection) are applied to the ohmically heated stellarator plasma and also to the Tokamak plasma. The bulk ion heating efficiency for co-injection is around 1.6 eV/KW in the case of stellarator and 1.9 eV/kW in the case of Tokamak, while the heating efficiencies for counter-injection are about 1.6eV/kW in both cases. The difference between the Tokamak and stellarator is considered to be caused by the enhanced orbit loss due to the helical ripples in the stellarator. Author

N80-32228# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
TESTS OF A LIGHTWEIGHT 200 kW MHD CHANNEL AND DIFFUSER Final Report, Mar. 1977 - Dec. 1978
James F. Holt and Jerome Pearson Mar. 1980 175 p refs
(AF Proj. 3145)
(AD-A087022; AFWAL-TR-80-2021) Avail: NTIS HC A08/MF A01 CSCL 10/2

A 200 kW lightweight MHD generator channel and diffuser were tested over a regime of 235 individual firings of the open cycle combustor systems. The diagonal conducting wall channel delivered full rated power with no interelectrode breakdown. Vibration measurements indicated no fatigue of the channel structure. GRA

N80-32227# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ELECTROMAGNETIC OSCILLATING TWO STREAM INSTABILITY OF PLASMA WAVES
C. S. Liu and V. K. Tripathi May 1980 16 p refs
(Contracts N00014-77-C-0590; DE-A505-77DP-40032)
(AD-A087732; PUB-80-178; TR-80-101) Avail: NTIS HC A02/MF A01 CSCL 20/9

Oscillating two stream instability, in which a plasma wave decays into a zero frequency electrostatic mode and two Langmuir wave sidebands has been known for some time and shown to be an important nonlinear process leading to soliton formation, plasma collapse, etc. In this paper we have investigated the electromagnetic oscillating two stream instability of electrostatic and electromagnetic plasma waves of finite wave number by which a pump wave decays into a purely growing electromagnetic mode and two sidebands, viz., Langmuir waves of shorter wavelengths. In the case of an electromagnetic pump, i.e., a laser radiation, we have studied this instability including the effect of plasma inhomogeneity and shown its importance as a source of self-generated magnetic fields in laser fusion experiments. GRA

N80-32228# Naval Surface Weapons Center, White Oak, Md.
PLASMA INSTABILITY IN ELECTRON AND POSITRON COLLIDING BEAMS IN STORAGE RING
Han S. Uhm and Chuan S. Liu (Maryland Univ., College Park) Apr. 1980 31 p refs Submitted for publication
(Contract N00014-77-C-0590)
(AD-A087733; PUB-80-180; TR-80-103; PL-80-040) Avail: NTIS HC A03/MF A01 CSCL 20/7

The filamentation instability of the electron and positron colliding beams in a storage ring are investigated within the framework of the rigid beam model and the Vlasov-Maxwell equations, and closed algebraic dispersion relations for the complex eigenfrequency omega are obtained. It is shown that the typical growth rate of instability is a substantial fraction of the electron plasma frequency omega(pe), thereby severely limiting the electron density in storage ring. Moreover, the influence of collective self-field effects on the electron and positron colliding beams in the storage ring is investigated. The analysis is carried out, distinguishing the cases, where (a) the particle motions are in a very coherent orbit, and (b) the randomness dominates the operational condition of a storage ring (e.g., the incoherent collision location by small fluctuation, etc.). In either case, it is shown that the self-fields effects play a dominant role in the stability behavior of transverse orbit or the expansion of the beam cross sections. GRA

N80-32229# Maryland Univ., College Park. Dept. of Physics and Astronomy.
IRREVERSIBILITY AND TRANSPORT IN THE LOWER HYBRID DRIFT INSTABILITY
J. F. Drake Mar. 1980 36 p refs
(Contracts N00014-79-C-0665; DE-AC05-79ET-53044)
(AD-A087728; PUB-80-155; TR-80-088) Avail: NTIS HC A03/MF A01 CSCL 20/9

The dynamics of electrons in a low frequency wave propagating perpendicular to a uniform magnetic field are studied and the implications of these results for transport and heating by the lower hybrid drift instability are explored. Below a threshold e phi/T(i) approximately .25-.5, all electron energy and momentum exchange with the wave are reversible and no plasma transport is possible. Above this threshold, trapping of electrons by the wave potentials takes place and causes irreversible electron heating and momentum exchange. These results imply that anomalous transport in inhomogeneous plasma with weak drifts (diamagnetic velocity less than the ion thermal velocity) may be substantially less than previously predicted. GRA

N80-32230# Westinghouse Electric Corp., Philadelphia, Pa. Advanced Energy Systems Div.
MHD ELECTRODE DEVELOPMENT Quarterly Report, Jan. - 31 Mar. 1979
John W. Sadler, Jeff Bein, David L. Black, Laurence H. Cadoff, James A. Dilmore, Alfred G. Eggers, Edsel W. Frantti, Edgar L. Kochka, Jack A. Kuszyk, and S. K. Lau May 1979 186 p refs
(Contract DE-AC01-79ET-15529)
(FE-15529-2) Avail: NTIS HC A09/MF A01

Zirconia based electrode compositions are selected for inclusion in the up coming nonslagging super hot WESTF test 42. Fabrication and processing details for these materials are presented. Test results were used to rank these materials as candidates for use under the slagging hot or nonslagging super hot operating modes. Laboratory screening tests, including electrochemical and anode arc erosion tests, have continued. A comprehensive analytical model was derived which permits detailed analysis of the role of slag properties as well as electrode slag polarization on the nature of electrochemical reactions under hot slagging conditions. Anode arc erosion tests were extended to provide preliminary data on the effect of potassium carbonate/slag versus potassium sulfate/slag mixtures on the arc erosion of copper and platinum clad copper anode samples. The results indicate increased arc damage for the sulfate/slag mixture. DOE

N80-32231# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
MHD HIGH PERFORMANCE DEMONSTRATION EXPERIMENT Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
Jan. 1980 44 p
(Contract ET-78-I-01-2895)
(FE-2895-7) Avail: NTIS HC A03/MF A01

The attainment of MHD performance on a sufficiently large scale to verify that the projected efficiency of the commercial MHD concept is considered. Shakedown testing of the magnet and flow train was completed and operation of the HPDE system in the Faraday power producing mode has continued. A peak power of about 18 MW was produced with a magnetic field of 2.8 T. Significant results which were obtained involved a definition of the transverse voltage characteristics, including the voltage drop near the electrode walls, and a definition of the fluid flow through the channel and diffuser. Several operational problems

were encountered including erosion of heat sink components of the burner and channel entrance and Hall potential shorting at the aft end of the channel and diffuser. Required hardware procurement and modification were initiated by the end of the quarter to solve these problems. DOE

N80-32232# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT, CHARACTERIZATION AND EVALUATION OF MATERIALS FOR OPEN CYCLE MHD Quarterly Report, period ending Sep. 1979
J. Lambert Bates and D. D. Marchant Nov. 1979 59 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RL-01830)
(PNL-2004-12) Avail: NTIS HC A04/MF A01

The development of hafnium rare earth oxides, with demonstrated potential for MHD hot electrode, continues at a high level. Procedures for fabricating high density ceramic compacts with uniform microstructures at temperatures below 1875 K for three compositions were developed. Bars of these materials are being fabricated for testing in the Westinghouse WESTF facility. Yttrium chromites, which have also shown potential for hot electrodes, are being fabricated into test bars by a commercial supplier. These materials are being prepared for testing in ESTF. The required electrical conductivity and thermal conductivity are being measured for these electrode materials. The RFG air preheater refractory, tested in Montana State University's heat exchangers was characterized and evaluated. The potential mechanism for corrosive attack by the molten slag was identified. DOE

N80-32233# General Atomic Co., San Diego, Calif.
CONCEPTUAL DESIGN OF RST: AN rf-DRIVEN, STEADY-STATE TOKAMAK Final Report
R. Prater, D. Bhadra, L. Bikadi, R. Bourque, W. Chen, C. Chu, J. Dalessandro, R. Harvey, M. Henderson, T. Ohino et al Mar. 1980 251 p refs
(EPRI Proj. 323-3)
(EPRI-AP-1351) Avail: NTIS HC A12/MF A01

The preliminary conceptual design of a radio frequency driven, steady state Tokamak (RST), is described. The function of RST was to develop the physics and engineering bases for the development of the Tokamak as a true steady state reactor. The physics of radio frequency current drive, using a variety of electromagnetic waves, is discussed. The device made use of a novel superconducting toroidal magnetic field coil concept, in which the axial current was carried in only three return legs, and superconducting pullback coils were used to reduce the magnetic field ripple. This technique greatly increases access to the plasma. Impurity control by means of edge cooling, bundle divertor, and radio frequency wave momentum sources is discussed, as well as fueling. DOE

N80-32234# Aerodyne Research, Inc., Bedford, Mass.
CHARACTERIZATION OF OPEN-CYCLE, COAL-FIRED MHD GENERATORS Quarterly Technical Progress Report, 1 May - 31 Jul. 1979
C. E. Kolb, J. Wormhoudt, V. Yousefian, W. Cheng, F. Bien, D. Dvore, and M. Martinez-Sanchez Aug. 1979 88 p refs
(Contract EX-76-C-01-2478)
(ARI-RP-46; QTPR-11) Avail: NTIS HC A05/MF A01

A diffusion controlled heterogeneous condensation model and channel heat loss model for incorporation into the PACKAGE code used to calculate core flow plasma properties and generator efficiency were developed. PACKAGE calculations comparing realistic baseload subsonic and supersonic generator models are also presented. The refinement of a laboratory scale coal combustion plasma source and its associated molecular beam mass spectrometer diagnostic and diode laser absorption plasma temperature measurement systems was documented. A numerical model describing arc behavior in magnetohydrodynamic electrode boundary layers is presented. DOE

N80-32235# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTIVITY AND CRYOGENICS FOR MIRROR FUSION
D. N. Cornish 19 May 1980 22 p refs Presented at the 8th Intern. Cryog. Eng. Conf., Genoa, 3 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-83916; CONF-800631-5) Avail: NTIS HC A02/MF A01

A brief introduction to the mainline experiments being presently pursued in mirror fusion research is followed by a more detailed description of the cryogenic and superconductive aspects of the Mirror Fusion Test Facility and its extension to a tandem machine. The large volume of magnetic field required for confinement has maximum intensity of close to 8 T and is produced by a variety of superconducting magnets. A large and complex cryogenic system is necessary to provide the 4 K environment for these coils and to meet the large cryopumping needs of the machine. DOE

N80-32236# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
EVALUATION OF TWO-BEAM SPECTROSCOPY AS A PLASMA DIAGNOSTIC Ph.D. Thesis
Barton Dawes Billard Apr. 1980 212 p refs
(Contract W-7405-eng-48)
(LBL-10913) Avail: NTIS HC A10/MF A01

A two beam spectroscopy system was evaluated theoretically and experimentally. This new spectroscopic technique uses correlations between components of emitted light separated by a small difference in angle of propagation. It is thus a non-perturbing plasma diagnostic which was shown to provide local (as opposed to line of sight averaged) information about fluctuations in the density of light sources within a plasma. This information was not obtainable by the usual spectroscopic methods. DOE

N80-32237# Texas Univ., Austin. Fusion Research Center.
DIRECT OHMIC HEATING OF POSITIVE IONS IN TOKAMAK PLASMAS
A. A. Ware Mar. 1980 26 p refs
(Contract DE-AC05-76ET-53036)
(DOE/ET/53036-16) Avail: NTIS HC A03/MF A01

Two mechanisms which will transfer part of the ohmic heat from the electrons to the ions are described. The direct ohmic heating of the ions was considered. The magnetic pumping cooling of the electrons and associated magnetic pumping heating of the ions caused by the poloidal rotation of the plasma were considered. Both mechanisms caused rates of energy transfer which were of the same order of magnitude as the collisional transfer and are therefore important corrections to be considered in both electron and ion energy containment calculations. DOE

N80-32238# Argonne National Lab., Ill.
MATERIALS PROGRAM PLAN FOR INERTIAL CONFINEMENT FUSION
A. Garde, B. O. Hall, S. D. Harkness, P. S. Maiya, M. D. Rechtin, and C. Y. Li (Cornell Univ., Ithaca, N.Y.) Aug. 1979 87 p refs
(Contract W-31-109-eng-38)
(ANL/FPP-TM-126) Avail: NTIS HC A05/MF A01

The effect of the irradiation environment on the microstructure of materials was studied. The importance of pulse effects on microstructural development was evaluated. The development effort that is necessary to cope with the high cycle loading of the first wall structure was studied. The interrelationship between specimen and component testing is presented. Static mechanical property requirements are also considered. Lithium compatibility was treated. DOE

N80-32239# California Univ., Livermore. Lawrence Livermore Lab.
HEAT TRANSFER IN INERTIAL CONFINEMENT FUSION REACTOR SYSTEMS
Jack Hovingh 23 Apr. 1980 23 p refs Presented at the 19th Natl. Heat Transfer Conf., Orlando, Fla., 27-30 Jul. 1980
(Contract W-7405-eng-48)
(CONF-800723-8) Avail: NTIS HC A02/MF A01

The short time and deposition distance for the energy from inertial fusion products resulted in local peak power densities. An overview of the various inertial fusion reactor designs which attempt to reduce these peak power intensities and the heat transfer considerations for each design are presented. DOE

N80-32240# Sandia Labs., Albuquerque, N. Mex.
PULSED POWER TECHNOLOGY FOR PARTICLE BEAM FUSION
J. P. VanDevender, T. H. Martin, E. L. Neau, J. T. Crow, and G. Yonas 1980 8 p Presented at the Intern. Conf. on Lasers, Shanghai, 3 May 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0696C; CONF-800555-1) Avail: NTIS HC A02/MF A01

A brief review of the Particle Beam Fusion Accelerator I is given. Its advantages for inertial confinement fusion are described. Author (DOE)

N80-32241# Brookhaven National Lab., Upton, N. Y.
HYPERFUSE: A NOVEL INERTIAL CONFINEMENT SYSTEM UTILIZING HYPERVELOCITY PROJECTILES FOR FUSION ENERGY PRODUCTION AND FISSION WASTE TRANSMUTATION
Henry Makowitz, James R. Powell, and Richard Wiswall 1980 14 p refs Presented at the 2nd Intern. Conf. on Emerging Nucl. Energy Systems, Lausanne, Switzerland, 8 Apr. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27784; CONF-800446-4) Avail: NTIS HC A02/MF A01

Parametric system studies of an inertial confinement fusion (ICF) reactor system to transmute fission products from an LWR economy were carried out. The ICF reactors would produce net power in addition to transmuting fission products. The particular ICF concept examined is an impact fusion approach termed HYPERFUSE, in which hypervelocity pellets, traveling on the order of 100 to 300 km/sec, collide with each other or a target block in a reactor chamber and initiate a thermonuclear reaction. The DT fusion fuel is contained in a shell of the material to be transmuted. The 14 MeV fusion neutrons released during the pellet burn cause transmutation reactions that convert the long lived fission products either to stable products or to species that decay with a short half life to a stable product. DOE

N80-32242# Research Inst. of National Defence, Stockholm (Sweden).
RELAXATION OF CHARGED PARTICLES INJECTED INTO A HOT PLASMA
Nils Hoernquist Mar. 1980 19 p refs
(FOA-C-20342-A2) Avail: NTIS HC A02/MF A01

Relaxation ranges and times of charged particles injected into a hot plasma are derived and compared with classical theory. Distant collisions as well as a more vigorous expression for close collisions are taken into account, revealing a significant difference for ion-ion relaxation. By using Bethe's formula for the stopping power of an energetic particle injected into a solid and redefining the ionization potential into a 'plasma potential' by dimensional arguments, an expression for the plasma case is derived and shown to be in qualitative accord with the rigorous expression for relaxation. Author (ESA)

N80-32243# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).
CURRENT OPERATION AND FUTURE USES OF HIGH POWER PLASMA GENERATORS [EXPLOITATION ACTUELLE ET PERSPECTIVES D'UTILISATION DES GENERATEURS DE PLASMA DE GRANDE PUISSANCE]
M. Labrot Paris 1980 16 p In FRENCH Presented at Journees d'Etudes sur l'Electrothermie Facteur de Mutation et de Develop. Ind., Versailles, France, 6-7 Mar. 1980
(SNIAS-801-430-104) Avail: NTIS HC A02/MF A01

A plasma generator was built to simulate the conditions associated with the reentry of space vehicles into the atmosphere. Its configuration is given together with the attainable performance. The different types of captor used to measure the various related parameters are exposed together with a brief analysis of the basic laws governing the phenomena taking place. The results of one year of operation are given. Certain industrial applications such as thermal drilling are envisaged. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-32244* National Aeronautics and Space Administration. Pasadena Office, Calif.
MEANS FOR GROWING RIBBON CRYSTALS WITHOUT SUBJECTING THE CRYSTALS TO THERMAL SHOCK-INDUCED STRAINS Patent
Samuel Berkman (RCA, Princeton, N.J.), Kyong-Min Kim (RCA, Princeton, N.J.), and Harold E. Temple, inventors (to NASA) (RCA, Princeton, N.J.) Issued 5 Aug. 1980 5 p Filed 31 Aug. 1978 Supersedes N79-10917 (17 - 01, p 0121) Sponsored by NASA
(NASA-Case-NPO-14298-1; US-Patent-4,216,186; US-Patent-Appl-SN-938579; US-Patent-Class-422-246; US-Patent-Class-156-DIG.96) Avail: US Patent and Trademark Office CSCL 20B

A susceptor particularly suited for use in growing a ribbon crystal employing edge defined film fed growth techniques is described. The susceptor includes a die through which a melt is drawn for forming a crystal ribbon. This is combined with a coolant delivery system characterized by a pair of jets for directing a stream of fluid coolant along a path extended to impinge on the susceptor in close proximity with the die in nonincident relation with the crystal being grown.

Official Gazette of the U.S. Patent and Trademark Office

N80-32245* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF GROWING A RIBBON CRYSTAL PARTICULARLY SUITED FOR FACILITATING AUTOMATED CONTROL OF RIBBON WIDTH Patent
Theodore F. Ciszek, inventor (to NASA) (IBM, Poughkeepsie, N.Y.) Issued 12 Aug. 1980 8 p Filed 28 Apr. 1978 Supersedes N78-24952 (17 - 15, p 2056) Sponsored by NASA
(NASA-Case-NPO-14295-1; US-Patent-4,217,165; US-Patent-Appl-SN-901055; US-Patent-Class-156-601; US-Patent-Class-156-617SP; US-Patent-Class-156-DIG.64; US-Patent-Class-156-DIG.88) Avail: US Patent and Trademark Office CSCL 20B

A method of growing a ribbon crystal is described wherein a meniscus of molten semiconductor material attached to vertical movable seed is lifted at a rate substantially equal to the rate at which the meniscus freezes. The method is characterized by the steps of continuously sensing the brightness of the growth region of the ribbon in selected areas across the ribbon width for detecting changes in the intensity of the brightness of the selected areas, and modifying the temperature of the meniscus and pulling speed in response to changes detected in the intensity for controlling the geometry of the ribbon.

Official Gazette of the U.S. Patent and Trademark Office

N80-32246*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRYSTAL CLEAVING MACHINE Patent Application
John S. J. Benedicto and Frederick C. Hallberg, inventors (to NASA) Filed 29 Aug. 1980 19 p
(NASA-Case-GSC-12584-1; US-Patent-Appl-SN-182879) Avail: NTIS HC A02/MF A01 CSCL 20B

A machine is disclosed for cleaving hard crystals with precision and uniformity. It includes a vertical axis positioning control means for an adjustable spring tension guided hammer mechanism employed to strike an anvil and thereby generate a crystal cleaving shock wave transmitted to a cleaving blade. An underlying crystal holding fixture with horizontal position control means includes a zero reference stop face for the crystal and opposing spring loaded clamping and vertical positioning elements which are precisely guided. The crystal is restrained only to the extent that it remains in an ideal position for cleaving until the shock wave begins to propagate along a cleavage plane. Thus the shock wave forces that separate the crystal are balanced and the light restraining force used to hold the crystal allows it to splay apart with minimal shock wave damping. NASA

N80-32247*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL TECHNIQUES FOR DETERMINATION OF THE ROLE OF DIFFUSION AND CONVECTION IN CRYSTAL GROWTH FROM SOLUTION
L. Zefiro Mar. 1980 16 p refs Transl. into ENGLISH from Rend. Soc. Ital. Mineral. Petrologia (Italy), v. 34, no. 2, 1978 p 663-673 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Genoa Univ., Italy
(Contract NASw-3199)
(NASA-TM-76131) Avail: NTIS HC A02/MF A01 CSCL 20L

Various studies of the concentration of the solution around a growing crystal using interferometric techniques are reviewed. A holographic interferometric technique used in laboratory experiments shows that a simple description of the solution based on the assumption of a purely diffusive mechanism appears inadequate since the convection, effective even in reduced columns, always affects the growth. A.R.H.

N80-32248# Honeywell Corporate Technology Center, Bloomington, Minn.
FEASIBILITY OF OPEN TUBE SLIDER GROWTH OF HgCdTe FROM Te-RICH SOLUTION Interim Technical Report, Jan. 1979 - Jan. 1980
Joseph L. Schmit and John E. Boners Feb. 1980 62 p refs
(Contract F33615-77-C-5142; AF Proj. 2423)
(AD-A086342; AFWAL-TR-80-4068) Avail: NTIS HC A04/MF A01 CSCL 20/2

This report covers the feasibility demonstration of the growth of Hg1-xCdxTe by liquid phase epitaxy from Te-rich solution at atmospheric pressure. Growth parameters are calculated from the phase diagram, measurement methods are described for determining layer thickness, uniformity, composition, and electrical properties. Substrate preparation and the growth process are described. Comparisons are made with growth from Hg-rich and HgTe-rich solutions. Layers as thin as 2 micrometers and as thick as 54 micrometers have been grown; most layers are 1 cm sq but some are 2x3 cm sq. We conclude that LPE growth is feasible from Te-rich solution at atmospheric pressure and are continuing our efforts to optimize the growth parameters and to increase the layer area. GRA

N80-32249# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
FABRICATION OF JOSEPHSON TUNNEL JUNCTIONS BY REACTIVE ION MILLING
Alan W. Kleinsasser and Robert A. Buhrman 21 Jul. 1980 12 p refs
(Contract N00014-76-C-0526)
(AD-A087448; Rept-80-3) Avail: NTIS HC A02/MF A01 CSCL 20/10

A new technique has been developed for growing high quality, ultrathin oxide layers on metal films, suitable for use as tunneling barriers in Josephson junction devices. The oxides are produced with an argon oxygen ion beam, and the rate of growth is determined by the competition between oxidation and sputtering by the ions. The oxidation technique has been applied to the fabrication of high current density submicron niobium lead alloy Josephson junctions. High quality junctions have been produced with critical current densities exceeding 100,000 amp/sq cm and having low leakage currents at voltages below the energy gap. An edge geometry has been developed, allowing in line junctions to be formed on the ion mill patterned edge of Nb film. In this way, junction width is controlled by the Nb film thickness. GRA

N80-32250# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
HIGH QUALITY SUBMICRON NIOBIUM TUNNEL JUNCTIONS WITH REACTIVE ION BEAM OXIDATION
Alan W. Kleinsasser and R. A. Buhrman 22 Jul. 1980 15 p refs
(Contract N00014-76-C-0526; NR Proj. 319-096)
(AD-A087449; Rept-80-4) Avail: NTIS HC A02/MF A01 CSCL 20/10

A new reactive ion beam oxidation technique has been applied to the fabrication of rugged, high quality niobium-lead alloy Josephson tunnel junctions. Control of critical current density over a wide range is possible, and critical current densities exceeding 1 million amp/sq cm have been obtained. In addition, a process-compatible edge geometry has been developed which allows a junction to be formed on the faceted edge of a niobium base electrode, yielding devices with areas of 10 to the minus 9th power sq cm using 1 micrometer photolithography. GRA

N80-32251# Wisconsin Univ. - Madison. Dept. of Metallurgical and Mineral Engineering and Materials Science Center.
SURFACE DEFECTS AND THERMODYNAMICS OF CHEMISORBED LAYERS
M. G. Lagally, T.-M. Lu, and D. G. Welkie 14 Sep. 1979 35 p refs
(Contract N00014-76-C-0727; NR Proj. 392-014)
(AD-A086918) Avail: NTIS HC A03/MF A01 CSCL 07/4

Chemisorbed overlayers on single crystal surfaces can in many cases be considered as lattice gases. The general features of temperature-coverage phase diagrams resulting from attractive or repulsive adatom interactions in such systems are discussed in analogy with binary solid solutions. The effect of surface and overlayer defects on the determination of phase boundaries is considered. The use of low energy electron diffraction (LEED) to study surface defects and overlayer phase diagrams is briefly summarized. GRA

N80-32252# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
ORGANIC METALS AND SEMICONDUCTORS: THE CHEMISTRY OF POLYACETYLENE, CH(X), AND ITS DERIVATIVES Interim Technical Report
Alan G. MacDiarmid and Alan J. Heeger 21 Oct. 1979 14 p refs Presented at the Advan. Study Inst. on the Phys. and Chem. of Low Dimensional Solids, Tomar, Portugal, Aug. 1979
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A087102; TR-79-8) Avail: NTIS HC A02/MF A01 CSCL 07/3

Both cis- and trans-forms of polyacetylene, (CH)(x), may prepared as silvery, flexible polycrystalline, semiconducting films. The cis-films can be stretched to over three times their original length with partial alignment of the (CH)(x) fibrils. Through chemical or electrochemical doping, the electrical conductivity of the films can be increased over twelve orders of magnitude with properties ranging from insulator to semiconductor to metal. By the use of donors or acceptors, n-type or p-type polymer, respectively, is produced. Photoelectrochemical photovoltaic cells have been fabricated using (CH)(x) as the active photoelectrode. GRA

N80-32253# Stanford Univ., Calif. Edward L. Ginzton Lab.
SUPERCONDUCTING TUNNELING AND TUNNELING APPLICATIONS IN HIGH Tc A15 SUPERCONDUCTORS Final Report
M. R. Beasley May 1980 39 p refs
(Contract N00014-77-C-0439)
(AD-A087125; GL-3133) Avail: NTIS HC A03/MF A01 CSCL 20/3

This program was an outgrowth of our early empirical successes in forming superconducting tunnel junctions on thin films of the high transition temperature superconductors, specifically those in the so-called A15 class such as Nb3Sn (Tlc) approximately 18 K) and V3Si (Tlc) approximately 16 K). Prior to this all attempts at tunneling in the A15 superconductors had been on bulk material and were not widely successful. Moreover such non-thin film junctions are of limited device interest. As a result of this program we now have general junction formation techniques, apparently suitable for the A15 superconductors as a class, which are being routinely used for material diagnostics and for studies of the superconducting properties of these materials. More importantly, perhaps, they appear to have important device potential. We summarized only the main results and conclusions, referring the reader to the appendix for a more comprehensive discussion. GRA

N80-32254# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
ORGANIC METALS AND SEMICONDUCTORS: POLYACETYLENE (CH)x AND ITS DERIVATIVES

Alan G. MacDiarmid and Alan J. Heeger 21 Oct. 1979 12 p refs Submitted for publication
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A087024; LRSM-TR-79-9) Avail: NTIS HC A02/MF A01 CSCL 07/3

Polyacetylene (CH sub x) is the simplest organic polymer. Both the cis- and trans-forms may be prepared as silvery, flexible, polycrystalline, semiconducting films. The cis-films can be stretched over three times their original length with partial alignment of the (CH) fibrils. Through chemical or electrochemical doping, the electrical conductivity of the films can be increased over twelve orders of magnitude with properties ranging from insulator to semiconductor to metal. By the use of donors or acceptors n-type or p-type polymer, respectively, is produced. When doped, the partly aligned (CH) films show marked anisotropic electrical and optical properties. Studies have shown that rectifying p-n junctions as well as Schottky barrier junctions can readily be fabricated from polyacetylene. GRA

N80-32255# Hughes Research Labs., Malibu, Calif.
ADVANCED SILICON MATERIAL DEVELOPMENT FOR LADIR Interim Report, 15 Aug. 1978 - 15 Aug. 1979
H. Kimura and O. J. Marsh Jun. 1980 48 p
(Contract F33615-78-C-5062)
(AD-A087286) Avail: NTIS HC A03/MF A01 CSCL 17/5

This interim report gives dopant distribution results from several float zoned 100 silicon crystals. Uniformity of Ga improves as the growth rate is decreased and the rotation rate during growth is increased. These results agree qualitatively with diffusion theory and show promise of substantial uniformity improvement over state of the art SiGa material for IR detector applications. GRA

N80-32256# University of Southern California, Los Angeles. Dept. of Electrical Engineering.
CHARGE STORAGE, RETENTION AND ENDURANCE IN MNOS DEVICES Final Report, 10 Apr. 1977 - 13 Apr. 1980
Kurt Lehovec 13 Jun. 1980 47 p refs
(Contract DAAG29-79-C-0095; Grants DAAG29-78-G-0100; DAAG29-77-G-0123)
(AD-A087432; ARO-14744.6-EL) Avail: NTIS HC A03/MF A01 CSCL 20/12

The steady state current through the double dielectric of MNOS capacitors on p-silicon substrate was measured as function of temperature for several fixed fields in the silicon oxide of a polarity promoting hole flow from the silicon. It is shown that the availability of empty recipient trap states for holes tunneling from the silicon into the nitride controls the current. The occupancy of these trap states is governed by Frenkel-Poole detrapping at elevated temperatures and by Fowler-Nordheim tunnel emission from the traps at low temperature. Transient charging measurements support this interpretation. GRA

N80-32257# Advanced Research and Applications Corp., Sunnyvale, Calif.
IMPROVEMENT IN GaAs DEVICE YIELD AND PERFORMANCE THROUGH SUBSTRATE DEFECT GETTERING Final Report, 1 Feb. 1978 - 19 Jun. 1980
T. J. Magee, J. Peng, R. Ormond, R. A. Armistead, M. Malbon (Avantek, Inc., Santa Clara, Calif.), and C. A. Evans, Jr. (C. Evans and Associates) Jun. 1980 119 p refs
(Contract N00014-78-C-0065; ARPA Order 0010; NR Proj. 243-022)
(AD-A087712; ARACOR-TR-19-3) Avail: NTIS HC A06/MF A01 CSCL 20/12

The use of mechanically produced, back surface damage as a means of gettering impurities and defects in GaAs wafers has been investigated. Comparative analyses have been done on both ion implantation and mechanical back surface damage gettering techniques. The increased thermal stability of mechanically produced damage has shown ion implantation techniques to be less effective for gettering over long anneal periods at elevated temperatures. Stress gradients produced by graded dislocation distributions produce reductions in front surface defect concentrations and effective gettering of Au and Cr at the back surfaces. Thermal stability times of back surface damage at anneal temperatures of 700-800 C is typically on the order of 2 - 3 hours, corresponding to the point at which major back surface microstructural damage is largely annealed. Increases in the thermal stability period were attained by encapsulating the back surface with an As-doped SiO2 layer. Gettering of Cr by back surface damage was also investigated at low temperatures (300 C - 400 C) for anneal periods of 10 - 300 hrs. Measurable concentrations of Cr were detected with the process characterized by an activation energy of approximately 0.88 eV and a time dependent term, exp (theta square root of t). Using the developed gettering procedures, FET structures were fabricated on VPE layers on pregettered GaAs wafers. Dramatic improvements in yield per wafer, noise figures at higher frequencies and input capacitance values were obtained on 'inscreened' wafers processed through a normal fabrication line. GRA

N80-32258# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
PROPERTIES OF SUPERCONDUCTOR-NORMAL METAL-SUPERCONDUCTOR MICROBRIDGES Ph.D. Thesis
John Michael Warlaumont 21 Jul. 1980 179 p refs
(Contract N00014-76-C-0526; NR Proj. 319-096)
(AD-A087512; Rept-80-2) Avail: NTIS HC A09/MF A01 CSCL 09/5

This thesis describes the fabrication and electrical measurement of short, high resistance (R approx. 1 ohm) superconductor-normal metal-superconductor microbridges. These small (length and width as small as 200 nm), planar structures were produced using electron beam lithography and ion beam etching. Lead-copper-lead structures were primarily studied; other materials were also briefly investigated. The small cross section of the bridges resulted in a uniform current distribution in the bridges at all temperatures, thus enabling the experimental determination of the critical current versus temperature relation for all temperatures between T sub c and 0.05 T sub c, where T sub C is the transition temperature of the electrodes. The low voltage current voltage (I-V) characteristics were studied in detail. Constant voltage steps were observed in the I-V curves for all frequencies of microwave radiation used. The high resistance of these samples permitted measurement of the I-V curves for voltages much greater than the energy gap of the electrodes. A high voltage peak in the dV/dI curves was observed, and it was speculated that this peak was due to an extra dissipation in the electrodes. In addition, the low voltage resistance was found to have a temperature dependence which agreed with the phenomenological theory of Pippard et al., a theory which attributes the extra resistance to energy dissipation in the electrodes. GRA

N80-32259# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
THEORY OF JOSEPHSON JUNCTION MIXERS
Gosta J. Ehnholm 22 Jul. 1980 5 p
(Contract N00014-76-C-0526)
(AD-A087511; Rept-80-5) Avail: NTIS HC A02/MF A01 CSCL 09/5

A mathematical analysis of the rf irradiated Josephson junction has shown that an external load at the rf frequency is transformed into a parametric small signal Josephson junction seen at dc as a subharmonic step in the U-I characteristic. This model is used to investigate the properties of Josephson junction mixers. GRA

N80-32260# Sandia Labs., Albuquerque, N. Mex.
ELECTRONIC PROPERTIES OF SILICON GRAIN BOUNDARIES
G. E. Pike and C. H. Seager 1980 24 p refs Presented at the Conf. on Phys. of Fiber Optics, Chicago, 28 Apr. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2350C; CONF-800430-2) Avail: NTIS HC A02/MF A01

The theory of the electrostatic barriers which form at silicon grain boundaries are discussed with specific reference to polycrystalline silicon. The use of experimental conductance and capacitance measurements to obtain the barrier height and energy density of grain boundary states are illustrated. DOE

N80-32261# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
GRAIN BOUNDARY DISLOCATIONS IN PLANE MATCHING GRAIN BOUNDARIES
R. Schindler, J. E. Clemans, and R. W. Balluffi Aug. 1979

34 p refs
(Contract DE-AS02-78ER-05002)
(DOE/ER-05002/7) Avail: NTIS HC A03/MF A01

Secondary grain boundary dislocation structures were observed in plane matching boundaries over a relatively wide range of crystal misorientations and grain boundary orientations. Results indicate that many boundaries occurring in polycrystalline materials which have been assumed to be general boundaries in previous studies may actually have been special boundaries of the plane matching type. Also, it appears that such boundaries should be found in general polycrystalline material with a relatively high probability. R.C.T.

N80-32262# Sandia Labs., Albuquerque, N. Mex.
FUNDAMENTAL STUDIES OF GRAIN BOUNDARY PASSIVATION IN POLYCRYSTALLINE SILICON WITH APPLICATION TO IMPROVED PHOTOVOLTAIC DEVICES Final Research Report, Feb. - Dec. 1979
C. H. Seager and D. S. Ginley Feb. 1980 118 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0879) Avail: NTIS HC A06/MF A01

Several aspects of the electrical properties of silicon grain boundaries were studied. The temperature dependence of the zero bias conductance and capacitance of single boundaries was measured and shown to be in good agreement with a simple double depletion layer/thermal emission model developed to predict the transport properties of such structures. In addition, it was shown that deconvolution of the I-V properties of some boundaries yields effective one electron densities of trapping states which are in good agreement with estimates obtained by low temperature electron emission measurements. Experiments were also performed which indicate that diffusion of atomic hydrogen into silicon grain boundaries greatly reduces this density of trapping states. In properly prepared, large grained polycrystalline samples, all measurable traces of grain boundary potential barriers can be removed to substantial penetration depths after several hours exposure to a hydrogen plasma at elevated temperatures. Initial experiments on prototype polysilicon solar cells have shown that this passivation process can improve AM1 efficiencies. DOE

N80-32263# National Technical Information Service, Springfield, Va.
GUNN EFFECT DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1979 - May 1980
William E. Reed Jun. 1980 72 p Supersedes NTIS/PS-79/0599; NTIS/PS-78/0362
(PB80-812050; NTIS/PS-79/0599; NTIS/PS-78/0362) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The application of Gunn effect devices to microwave generation, amplification, and control is included in these reports from worldwide literature. The Gunn effect in semiconductors is discussed. Design, fabrication, and properties of Gunn diodes are included. This updated bibliography contains 64 abstracts, all of which are new entries to the previous edition. GRA

N80-32264# National Technical Information Service, Springfield, Va.
GUNN EFFECT DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1976 - Mar. 1979
William R. Reed Jun. 1980 299 p Supersedes NTIS/PS-78/0362; NTIS/PS-77/0257
(PB80-812068; NTIS/PS-78/0362; NTIS/PS-77/0257) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The application of Gunn effect devices to microwave generation, amplification, and control is included in these reports from worldwide literature. The Gunn in semiconductors is discussed. Design, fabrication, and properties of Gunn diodes are included. This update bibliography contains 290 abstracts, none of which are new entries to the previous edition. GRA

N80-32265# National Technical Information Service, Springfield, Va.
GUNN EFFECT AND TRANSFERRED ELECTRON DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1977 - May 1980
William E. Reed Jun. 1980 92 p Supersedes NTIS/PS-79/0598; NTIS/PS-78/0361
(PB80-812035; NTIS/PS-79/0598) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

A bibliography containing 99 abstracts addressing the Gunn effect and transferred electron devices is presented. The application of Gunn effect and transferred electron devices to microwave generation, amplification, and control is included. The Gunn effect in semiconductors is dicussed along with the design, fabrication, and properties of Gunn diodes and transferred electron devices. GRA

N80-32266# National Technical Information Service, Springfield, Va.
AMORPHOUS SEMICONDUCTORS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jun. 1980
Brian Carrigan Jun. 1980 191 p Supersedes NTIS/PS-79/0623; NTIS/PS-78/0671
(PB80-811342; NTIS/PS-79/0623; NTIS/PS-78/0617) Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

A bibliography containing 181 abstracts is presented on amorphous semiconducting thin films, chalcogenides, materials fabrication, properties, and testing. Amorphous semiconductor usage in electronic devices, laser materials, ovonic switches, and memory devices are included. GRA

N80-32267# National Technical Information Service, Springfield, Va.
TRANSFERRED ELECTRON DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - May 1980
William E. Reed Jun. 1980 250 p Supersedes NTIS/PS-79/0600; NTIS/PS-78/0363
(PB80-812043; NTIS/PS-79/0600; NTIS/PS-78/0363) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

A bibliography containing 242 abstracts addressing the application of transferred electron devices to microwave oscillation, amplification, and switching is presented. GRA

N80-32268# National Bureau of Standards, Washington, D.C. Electron Devices Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: TECHNICAL IMPEDIMENTS TO A MORE EFFECTIVE UTILIZATION OF NEUTRON TRANSMUTATION DOPED SILICON FOR HIGH-POWER DEVICE FABRICATION Final Report
D. R. Myers May 1980 38 p refs Sponsored in part by DOE
(PB80-183874; NBS-SP-400-60; LC-80-600047) Avail: NTIS HC A03/MF A01 CSCL 20L

The problems involved in the neutron transmutation doping process are summarized. The concerns related to damage in transmutation doped silicon resulting from the neutron irradiation are presented. Suggestions for future research are presented. GRA

N80-32269# National Bureau of Standards, Washington, D.C. Electron Devices Div.
THE NBS SEMICONDUCTOR TECHNOLOGY PROGRAM AND VLSI (VERY LARGE SCALE INTEGRATION)
W. Murray Bullis and R. I. Scace Jun. 1980 11 p refs
(PB80-185531; NBSIR-80-2057) Avail: NTIS HC A02/MF A01 CSCL 20L

Several examples of past successful programs and their significance are given. An outline of the present plans for expansion to cover the problems of very large scale integration (VLSI) is presented. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-32270*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PAYLOAD CREW TRAINING SCHEDULER (PACTS) USER'S MANUAL
David L. Shipman Jul. 1980 308 p
(NASA-TM-78284) Avail: NTIS HC A14/MF A01 CSCL 05A

The operation of the payload specialist training scheduler (PACTS) is discussed in this user's manual which is used to schedule payload specialists for mission training on the Spacelab experiments. The PACTS program is a fully automated interactive, computerized scheduling program equipped with tutorial displays. The tutorial displays are sufficiently detailed for use by a program analyst having no computer experience. The PACTS program is designed to operate on the UNIVAC 1108 computer system, and has the capability to load output into a PDP 11/45 Interactive Graphics Display System for printing schedules. The program has the capacity to handle up to three overlapping Spacelab missions. R.K.G.

N80-32271# Air Force Academy, Colo.
A RESEARCH ACTIVITIES MANAGEMENT SYSTEM Final Report, 1 Nov. 1979 - 27 Feb. 1980
John S. Wilkes Feb. 1980 43 p
(AF Proj. 2303)
(AD-A086576; FJSRL-TR-80-0007) Avail: NTIS HC A03/MF A01 CSCL 05/2

A Research Activities Management System is described. It is a computerized storage and retrieval system that allows the manager of a scientific or engineering research organization to receive an organized accounting of the research activities of the organization. The scope of the data base and the nature of the items comprising the data base are defined. Examples of the use of the system are presented, using the research activities of a chemistry basic research laboratory as the data base. GRA

N80-32272# Skelly and Loy, Harrisburg, Pa.
GENERAL APPLICATION OF THE CRITICAL PATH METHOD TO RESOURCE CHARACTERIZATION AND PLANNING FOR UNDERGROUND COAL MINING Final Technical Report
May 1980 287 p refs
(Contract DE-AC01-79ET-11268)
(DOE/ET-11268/3) Avail: NTIS HC A13/MF A01

Application of the critical path method (CPM) to the total mine planning process is described. A commercially available CPM software package called SPRED (Solution of the Precedence Diagram) was chosen. A key prerequisite to the application of CPM was the identification of all of the activities involved in the mine planning process and the determination of all of the interrelationships that exist between them. A network format depicted all of the activities as labeled boxes in their proper logical sequence of events. Interdependencies were shown by lines connecting the related activities. Information necessary for the application of critical path scheduling techniques was produced and the data prepared in the format suitable for input to the SPRED system. DOE

N80-31347# General Electric Co., Lynn, Mass. Aircraft Engine Group.
LOGISTICS FORECASTING FOR ACHIEVING LOW LIFE CYCLE COST
G. Walker *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 25 p refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-32273*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NSSDC AND WDC-A-R/S DOCUMENT AVAILABILITY AND DISTRIBUTION SERVICES
Jun. 1980 13 p
(NASA-TM-81120; NSSDC/WDC-A-R/S-80-02) Avail: NTIS HC A02/MF A01 CSCL 05B

Documents available from the National Space Science Data Center (NSSDC) and the World Data Center A for Rockets Satellites are described. The availability, costs, ordering procedures for documents presently available, and the procedures for obtaining future documents are given. NSSDC, established by NASA to further the widest practicable use of reduced data obtained from space science investigations and to provide investigators with an active repository for such data, is responsible for the active collection, organization, storage, announcement, retrieval, dissemination, and exchange of data received from satellite experiments. Information on sounding rocket investigations is also collected. A.R.H.

N80-32274# Range Commanders Council, White Sands Missile Range, N. Mex. Documentation Group.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. VOLUME 1: SYSTEM DESCRIPTION, PROGRAM INTRODUCTION AND STATEMENT OF CAPABILITY Final Report
Nov. 1979 91 p Supersedes DG-501-70-Vol-1 3 Vol.
(AD-A087072; DG-501-79-Vol-1; DG-501-70-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

This handbook describes the Universal Documentation System (UDS). The UDS is used to formally document user agency test program support requirements and support agency capabilities and commitments to support those requirements. The UDS handbook is published in three volumes. Volume 1 describes the total UDS structure, the individual documents within the system, and the use and control of the system. Volume 1 also includes sample forms and specific instructions for the Program Introduction (PI) and Statement of Capability (SC) documents which are the first level of UDS documents. GRA

N80-32275# Range Commanders Council, White Sands Missile Range, N. Mex.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. VOLUME 2: PROGRAM REQUIREMENTS AND OPERATIONS REQUIREMENTS DOCUMENTS
Nov. 1979 281 p 3 Vol.
(AD-A087073) Avail: NTIS HC A13/MF A01 CSCL 14/2

This handbook describes the Universal Documentation System (UDS). The UDS is used to formally document user agency test program support requirements and support agency capabilities and commitments to support those requirements. The UDS handbook is published in three volumes. This volume, Volume 2, describes the system and the procedure for preparation of the Program Requirements Document (PRD) and the Operations Requirements (OR) document. Each requirements document will be prepared by the user agency according to the format and policies prescribed in this volume. GRA

N80-32276# Defense Technical Information Center, Alexandria, Va. Directorate of Base Services.
SOURCE HEADER LIST, SUPPLEMENT 3 Progress Report, period ending 9 Jun. 1980
James P. Burrell Jun. 1980 301 p Supersedes DDC/TR-79/1-Suppl-2
(AD-A087000; DTIC/TR-80/5-Suppl-3; DDC/TR-79/1-Suppl-2) Avail: NTIS HC A14/MF A01 CSCL 05/9

Source names used by the Defense Technical Information Center in the Research and Technology Work Unit Information System, and the Technical Report, Program Planning, and Independent Research and Development Data Banks are compiled alphabetically. Each of the source names is assigned a 6 digit numeric code for computer input and retrieval, a 4 digit alphanumeric geopolitical code and a 1 digit alphanumeric type code. This supplement is a companion to the Source Header List, AD-A041700. GRA

N80-32277# Defense Technical Information Center, Alexandria, Va.
DATA ELEMENT DICTIONARY: DTIC UNIFORM DATA SYSTEM
Allan Kuhn, comp. and Melissa L. Young, comp. Apr. 1980 553 p
(AD-A083800; DTICH-4185.8) Avail: NTIS HC A24/MF A01 CSCL 05/2

The dictionary standardizes the data elements and identifies the data uses that constitute the Defense Technical Information Center uniform system. These standardized data elements enable DTIC to incorporate its data banks, currently operating independently, into a uniform system. They provide the capability of standardized access to all component data bases, or any combination of them. The dictionary serves as a communication link between system designers, programmers and subject specialists. It provides a foundation for effective management of data. Detailed descriptions of the current data banks and their relationships to the planned uniform system are included. Author (GRA)

N80-32278# Oak Ridge Gaseous Diffusion Plant, Tenn. Computer Sciences Div.
REVIEW OF DEPARTMENT OF ENERGY SPONSORED CODES AND DOCUMENTATION AVAILABLE FROM PURDUE AND LEHIGH UNIVERSITIES PROCESSES MODELING CONTRACTS
David M. Lister Apr. 1980 43 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-35) Avail: NTIS HC A03/MF A01

The Purdue project had two principal objectives. The first was to construct a modular computer simulation package for the design of coal conversion systems. The second was to use this package to study general coal conversion flowsheet alternatives. Seven general codes and seven models of major components of the modified Illinois Coal Gasification Group (ICGG) process were developed. The object of the Lehigh work was to select, assemble and develop numerical algorithms implemented as computer codes for the dynamic analysis and continuous simulation of the modified ICGG coal conversion plant. Two general-purpose programs and nine models of major components of the ICGG plant were developed. A brief description of these programs and their availability and performance on the Oak Ridge IBM computer systems are presented. DOE

N80-32279# Ohio State Univ., Columbus. Computer and Information Science Research Center.
INFORMATION FLOW AND ANALYSIS: THEORY, SIMULATION, AND EXPERIMENTS. PART 1: BASIC THEORETICAL AND CONCEPTUAL DEVELOPMENT. PART 2: SIMULATION EXAMPLES, AND RESULTS. PART 3: PRELIMINARY EXPERIMENTS AND ANALYSIS Final Report
M. C. Yovits, C. R. Foulk, and L. L. Rose Dec. 1979 84 p refs
(Grants NSF GN-41628; NSF IST-76-21949; NSF IST-79-08327)
(PB80-180995; OSU-CISRC-TR-80-4-Pt-1; OSU-CISRC-TR-80-4-Pt-2; OSU-CISRC-TR-80-4-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 05A

Research which has been underway to develop a fundamental and general theory of information flow and analysis is described. More specifically, the research attempts to: (1) identify and quantify important variables and parameters in the information flow process; (2) establish relationships among these variables; (3) apply the theory to practical situations and to examine the resulting implications; and (4) develop models, both simulation and experimental, to utilize and validate the theory. GRA

N80-32280# National Technical Information Service, Springfield, Va.
DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Brian Carrigan Jun. 1980 171 p Supersedes NTIS/PS-79/0710; NTIS/PS-78/0671
(PB80-812217; NTIS/PS-79/0710; NTIS/PS-78/0671) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of Federally-funded research cites studies on the concepts, design, development, implementation, and application of distributed data processing. Also included are studies on distributed data bases. General communication studies related to major computer networks are cited in another bibliography. This update bibliography contains 164 abstracts, 37 of which are new entries to the previous edition. GRA

N80-32281# National Technical Information Service, Springfield, Va.
DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jul. 1979 - May 1980
Brian Carrigan Jun. 1980 242 p Supersedes NTIS/PS-79/0711; NTIS/PS-78/0672
(PB80-812225; NTIS/PS-79/0711; NTIS/PS-78/0672) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites studies on the concepts, design, development, implementation, and application of distributed data processing. Also included are studies on distributed data bases. General communication studies related to major computer networks are cited in another bibliography. This updated bibliography contains 231 abstracts, all of which are new entries to the previous edition. GRA

N80-32282# National Technical Information Service, Springfield, Va.
DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1979
Brian Carrigan Jun. 1980 254 p Supersedes NTIS/PS-79/0711; NTIS/PS-78/0672
(PB80-812233; NTIS/PS-79/0711; NTIS/PS-78/0672) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites studies on the concepts, design, development, implementation, and application of distribution data processing. Also included are studies on distributed data bases. General communication studies related to major computer networks are cited in another bibliography. This updated bibliography contains 243 abstracts, none of which are new entries to the previous edition. GRA

N80-32283# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
INTERNATIONAL ACCESS TO AEROSPACE INFORMATION
Apr. 1980 105 p refs In ENGLISH and FRENCH Meeting held in Athens, 17-18 Oct. 1979
(AGARD-CP-279; ISBN-92-835-0264-7) Avail: NTIS HC A06/MF A01 CSCL 05B

A review of the status of Greek organization and facilities with respect to access to aerospace information is presented. The state of European cooperation in the field and the nature of NASA's contribution is considered. Requirements and tools for international cooperation and data exchange are discussed, as well as problems in the utilization of aerospace literature and nonliterature data in aerospace research and development. For individual titles, see N80-32284 through N80-32294.

N80-32284# Scientific Research and Technical Agency, (Greece).
ACCESS TO AEROSPACE INFORMATION: THE GREEK SITUATION
K. N. Kourogenis *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 4 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The establishment of the Greek National Information Program in the form of the National Documentation Center (NDC) is described. The role of the NDC is to create and coordinate a national network of scientific and technical data and information in accordance with international standards and to disseminate processed information to those interested with a view to the economic development of the country. Bibliographies, reprographic services and translation and terminology services are to be provided by the NDC. E.D.K.

N80-32285# European Space Agency, Frascati (Italy). Information Retrieval Service.
EUROPEAN COOPERATION IN FIELD OF AEROSPACE INFORMATION
W. A. Martin *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 10 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

Agreements reached in the early 1960's leading to the establishment of the ESRO/ELDO Space Documentation Service are reviewed. European cooperation in both the input of aerospace information and its utilization is described. Details of ESA-IRS activities in support of the NASA information system are given. The development of the use of aerospace information in Europe as evidenced by the growth of IRS networking is examined. Research into aerospace information handling is outlined. The relationship between ESA and the CEC is explained in the context of EURONET. E.D.K.

N80-32286*# National Aeronautics and Space Administration, Washington, D. C.
THE ROLE OF NASA FOR AEROSPACE INFORMATION
George P. Chandler, Jr. *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 4 p (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01 CSCL 05B

The NASA Scientific and Technical Information Program operations are performed by two contractor operated facilities. The NASA STI Facility, located near Baltimore, Maryland, employs about 210 people who process report literature, operate the computer complex, and provide support for software maintenance and developments. A second contractor, the Technical Information Services of the American Institute of Aeronautics and Astronautics, employs approximately 80 people in New York City and processes the open literature such as journals, magazines, and books. Features of these programs include online access via RECON, announcement services, and international document exchange. E.D.K.

N80-32287# British Library, London (England). International Centre for Bibliographic Descriptions.
STATE-OF-THE-ART OF STANDARDIZATION OF BIBLIOGRAPHIC DATA ELEMENTS
Harold Diericky *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 7 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The current situation with regard to standardization of data elements in bibliographic records is summarized. The following areas are considered: headings, bibliographic description proper, other areas or particular attributes of the bibliographic record. International and national rules and standards of international significance are dealt with. Although the difficulty for standardization efforts to suit the different requirements of various user groups is recognized, the conclusion reached is that standardization of form and presentation of bibliographic data elements is an essential prerequisite to achieve international compatibility of bibliographic records, particularly in an automated environment. Author

N80-32288# Netherlands School of Business, Breukelen.
STATE-OF-THE-ART OF DATA EXCHANGE: PROBLEMS OF FORMATS AND STANDARDS
J. S. MackenzieOwen *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 5 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The vast growth of bibliographic data services over recent years has produced many problems in the field of compatibility for data exchange. It is beginning to be understood that there exists a major gap between the library community on the one side, and the abstracting and indexing services on the other side. It is also becoming clear that any standardized format for bibliographic data exchange should be flexible enough to incorporate the diverse needs of many different users. An effort is being undertaken by UNESCO to solve these problems. The present situation, problems, and future developments in this field are described. E.D.K.

N80-32289# Institut fuer Flugmechanik, Brunswick (West Germany).
THE USE OF MULTILINGUAL REFERENCE TOOLS IN THE PRODUCTION AND TRANSFER OF TECHNICAL INFORMATION
Gerhard Rosenau *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 18 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

A survey of the problems of expressing technical information in one language is given. The discussion of the additional problems encountered in producing the information in more than one or in a foreign language leads to the description of the different types of multilingual reference tools, of their advantages, and of their deficiencies. Based on the experience gained during the revision of the AGARD Multilingual Aeronautical Dictionary criteria developed for a future multilingual reference system are presented. E.D.K.

N80-32290# Lucas Group Services Ltd., Solihull (England).
KINDS OF ACCESS TO UNCLASSIFIED LITERATURE
C. P. Auger *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 4 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The nature of unclassified literature is reviewed and the categories available and their organization are examined. The preponderance of reports literature is noted and current awareness and on line services receive particular attention. Consideration is given to the great variety of users seeking access for one reason or another and the different routes open to them. Finally attention is turned to some of the problems which need to be overcome if access is to be improved. E.D.K.

N80-32291# Centre de Documentation de l'Armement, Paris (France). Div. Information.
THE MANAGEMENT OF DOCUMENTS HAVING A RESTRICTED CHARACTER [LA QUESTION DES DOCUMENTS AYANT UN CARACTERE DE RESTRICTION]
J. H. Klopp *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 5 p ref In FRENCH (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

Documents containing military or industrial secrets or information reserved to the needs of the State are best managed in a manner analogous to that used for open documents, but with important security regulations imposed by a documentation center. It is preferable for a defense documentation center to create a chain of use parallel to the classic chain of use for open documents, rather than to intermingle documents. The most important advantage of the decision to create a special center

for processing classified documents is an uncontested control of the stamping, stocking, and dissemination of these documents. The importance of declassification is discussed and a table is provided showing the markings used by NATO and 14 of its member nations for the various classifications of restricted documents. Transl. by A.R.H.

N80-32292# Atomic Energy Research Establishment, Harwell (England). Computer Science Div.
FULL TEXT HANDLING: A CRITICAL REVIEW
R. P. L. Jones *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 10 p (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The wide capabilities of full text information retrieval systems are demonstrated. The basic capabilities of such systems are described including the strengths and weaknesses that seem to be inherent in the techniques that are in use. The wider application of such systems is also described. Emphasis is placed on their capability to form a nucleus for integrated information management systems which are flexible in use and do not require programming skills to exploit them. E.D.K.

N80-32293# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
THE NUMERIC AEROSPACE DATA: PROBLEMS OF EVALUATION, HANDLING AND DISSEMINATION
G. K. Hartmann *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 10 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

In context with dissemination and handling procedures the problems being faced are to distinguish between small, medium, and large information systems. Due to the fact that most of the numeric aerospace data are nonreproducible time series data (often also space dependent) with tremendous growth rates it is becoming extremely difficult and time consuming for any scientist and information system not actively working in the specific field to evaluate, disseminate, and handle those data with a high degree of efficiency and reliability. Thus it is very likely that also in the future, numeric aerospace data exchange activities will by far dominate the pure handling activities despite any technical progress. E.D.K.

N80-32294*# Lunar and Planetary Inst., Houston, Tex.
THE ROLE OF WORLD DATA CENTERS AND THE LUNAR AND PLANETARY INSTITUTE IN THE INTERNATIONAL EXCHANGE OF LUNAR AND PLANETARY DATA
Frances B. Waranius *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 8 p refs (For primary document see N80-32283 22-82)
(Grant NSR-09-051-001)
(LPI-Contrib-382) Avail: NTIS HC A06/MF A01

The success of many lunar and planetary investigations has resulted in the accumulation of a mass of data in a myriad of formats and medias. The application of these data to comparative planetology, origin of the solar system, and potential industrial applications of space has made it necessary for scientists from many disciplines to have access to the data. The collections of these data are so diverse that it is often difficult to select what is needed based on catalog information alone. The Lunar and Planetary Institute (LPI) proposes to bring the user and the data together. As a research support organization operated by the Universities Space Research Association, the LPI through its active Visiting Scientist Program, a balanced program of study workshops and topical conferences, and organized and supervised data collections has assisted scientists, educators, and students to review, study, and obtain the data necessary to the pursuit of their research. E.D.K.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.*

N80-32295# Council on Environmental Quality, Washington, D.C.
THE GLOBAL 2000 REPORT TO THE PRESIDENT. ENTERING THE TWENTY-FIRST CENTURY, VOLUME 1
1980 55 p refs 2 Vol.
Avail: SOD HC

Probable trends in population, resources, and environment were estimated between the year 1975 and 2000. Trend projections were developed using the long term global models employed by federal agencies. It is indicated that if present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world today. Major findings and conclusions are reported. R.C.T.

N80-32296# Council on Environmental Quality, Washington, D.C.
THE GLOBAL 2000 REPORT TO THE PRESIDENT. ENTERING THE TWENTY-FIRST CENTURY. VOLUME 2: THE TECHNICAL REPORT
1980 775 p refs 2 Vol.
Avail: SOD HC

Changes in pollution, climate, technology, Earth resources, energy, and the environment until the end of the century as projected by U.S. Government agencies using their most frequently employed long term planning models and analytical tools are discussed. A sequential approach was used to obtain a measure of self consistency, coherence, and interrelationship so as to provide an integrated global model which reflects the implications if current U.S. policies remain unchanged. Each of the models used is described and other global models are examined and compared with the global model developed. A.R.H.

N80-32297 Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
EXAMPLE OF A POLICY AIMED AT INCREASING THE VALUE OF SPIN-OFFS FROM SPACE TECHNOLOGY IN OTHER FIELDS [EXEMPLE D'UNE POLITIQUE DE VALORISATION DE RETOMBES TECHNOLOGIQUES SPATIALES DANS D'AUTRES DOMAINES]
Didier G. Compard Paris 1980 36 p In FRENCH Presented at Intern. Colloq. on the Econ. Effects of Space and Other Adv. Technol., Strasbourg, 28-30 Apr. 1980
(SNIAS-801-422-101) Avail: NTIS HC A03

Emphasis is given to applications derived from space systems, launching devices and ballistic motors. The underlying philosophy is presented together with the objectives sought. These applications concern energy (storage facilities, off-shore oil installations, nuclear and solar power), medicine, vehicle breaking systems, new materials, some specific technologies (extraction of metals, chemical synthesis, drilling), and safety (particularly in aeronautics. Special studies including the design and demonstration of systems for the chemical and petroleum industries, as well as software systems for ships and other proposes are also described. Some concrete examples are treated. Economics aspects are discussed together with expected developments.
Author (ESA)

N80-32298*# Budd Co., Fort Washington, Pa. Technical Center.
A MASS REDUCTION EFFORT OF THE ELECTRIC AND HYBRID VEHICLE Final Report
Richard B. Freeman and Herbert A. Jahnle Mar. 1980 193 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955283)
(NASA-CR-163520; TCR-0513; JPL-955283-1; JPL-9950-374) Avail: NTIS HC A09/MF A01 CSCL 13F

Weight reduction, cost competitiveness, and elimination of the intrusion beam resulted from the redesign and fabrication using composite materials of the door outer panel and intrusion beam from a Chevrolet Impala. The basis of the redesign involved replacing these two steel parts with a single compression molding using the unique approach of simultaneously curing a sheet molding compound outside panel with a continuous glass fiber intrusion strap. A weight reduction of nearly 11 pounds per door was achieved. Additional weight savings are possible by taking advantage of the elimination of the intrusion beam to design thinner door structures. The parts consolidation approach allows the composite structure to be cost competitive with the original steel design for both the lower production car models and for the near to midterm production vehicles using current state of the art composite production techniques. The design, prototype fabrication, costing, material, properties and compression molding production requirements are discussed. A.R.H.

N80-32299*# Battelle Columbus Labs., Ohio.
DESIGN STUDY OF STEEL V-BELT CVT FOR ELECTRIC VEHICLES Final Report
J. C. Swain, T. A. Klausing, and J. P. Wilcox Jun. 1980 131 p refs
(Contracts DEN3-116; EC-77-A-31-1044)
(NASA-CR-159845; DOE/NASA/0116-80/1) Avail: NTIS HC A07/MF A01 CSCL 13F

A continuously variable transmission (CVT) design layout was completed. The intended application was for coupling the flywheel to the driveline of a flywheel battery hybrid electric vehicle. The requirements were that the CVT accommodate flywheel speeds from 14,000 to 28,000 rpm and driveline speeds of 850 to 5000 rpm without slipping. Below 850 rpm a slipping clutch was used between the CVT and the driveline. The CVT was required to accommodate 330 ft-lb maximum torque and 100 hp maximum transient. The weighted average power was 22 hp, the maximum allowable full range shift time was 2 seconds and the required lift was 2600 hours. The resulting design utilized two steel V-belts in series to accommodate the required wide speed ratio. The size of the CVT, including the slipping clutch, was 20.6 inches long, 9.8 inches high and 13.8 inches wide. The estimated weight was 155 lb. An overall potential efficiency of 95 percent was projected for the average power condition.
Author

N80-32300# SRI International Corp., Menlo Park, Calif. Center for Resource and Environmental System Studies.
RAILROAD ELECTRIFICATION IN AMERICA'S FUTURE: AN ASSESSMENT OF PROSPECTS AND IMPACTS Final Report
Ronald K. White, Irving W. Yabroff, Edward M. Dickson, R. Allen Zink, Mary E. Gray, and Albert E. Moon Jan. 1980 175 p refs
(Contracts EY-76-C-03-1176; DE-AT03-76CS-50115)
(SAN-1176-T4) Avail: NTIS HC A08/MF A01

Such considerations as the level of traffic, the relative financial health of individual railroads, the capacity of the associated supply and engineering/construction industries, and the logical connecting points at classifying yards, as well as the national interest value of creating a continuous system, are used to construct a scenario for railroad electrification that closely approximates how an electrification program might be implemented. This scenario provides for an electrified network involving 14 mainlines operated by 10 companies that could transport much of the nation's rail borne freight. Five years of planning and engineering work would be required for each link before construction could begin. With 1000 miles or less of electrified route per year, 14 years would be needed to construct the 9000 mile network. Railroad energy costs, railroad freight levels, maintenance costs, purchases and leases of rolling stock, electrification facility investments, future inflation, rate setting practices, annual depreciation, taxes, and profits are calculated.
DOE

N80-32301# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
AN ATTEMPT TO ESTIMATE THE ECONOMIC EFFECTS IN THE CHOICE OF SPACE TECHNOLOGY SPIN-OFFS [TENTATAIVE D'ESTIMATION DES EFFETS ECONOMIQUES DANS LES CHOIX DE RETOMBES TECHNOLOGIQUES SPATIALES]
Jean-Michel Contant Paris 1980 9 p refs In FRENCH Presented at Intern. Colloq. on the Econ. Effects of Space and Other Adv. Technol., Strasbourg, 28-30 Apr. 1980
(SNIAS-801-422-107) Avail: NTIS HC A02/MF A01

The use of multicriteria methods to rationalize the choice of the particular technologies to be developed is presented. A methodical approach emphasizing the importance of economic, financial, commercial, and technological considerations is developed. It is concluded that some feedback is necessary, if subjective influences on the appreciation of the economic effects ensuing are to be overcome. The accounting services existing today in companies and organisations are not well adapted to conduct the type of analysis necessary. Author (ESA)

N80-32302# Transportation Systems Center, Cambridge, Mass.
ASSESSMENT OF OPERATIONAL AUTOMATED GUIDEWAY SYSTEMS-AIRTRANS, PHASE 2 Final Report, Jun. 1977 - Jul. 1979
C. W. Watt, D. Elliott, D. Dunoye, T. Dooley, and W. S. Kwok Jan. 1980 338 p refs Prepared in cooperation with Institut de Recherche des Transports, Arouell (France)
(PB80-182538; DOT-TSC-UMTA-79-19; UMTA-MA-06-0067-79-1) Avail: NTIS HC A15/MF A01 CSCL 13F

The automated guideway system at the Dallas-Fort Worth Airport, AIRTRANS, is assessed. Main areas covered include: (1) changes in system configuration including the addition of employee service and the modifications of the failure management and control systems; (2) the availability, reliability, and maintainability history of the system and its components; (3) the operational safety history of the system; and (4) a life cycle cost study of the system.
GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-32303*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE

VERSION OF THE CATALOG OF SUPPLEMENTAL STARS TO THE BONNER DURCHMUSTERUNG
Wayne H. Warren, Jr. May 1980 12 p refs
(NASA-TM-81119; NSSDC/WDC-A-R/S-80-01) Avail: NTIS HC A02/MF A01 CSCL 03A

The magnetic tape version of the Bonn catalog is described. The catalog contains a listing of supplemental stars having lower case letter designations following the BD numbers after which they have been inserted. A sample catalog is also presented. R.C.T.

N80-32304*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE PERTH 70: A CATALOGUE OF POSITIONS OF 24900 STARS TAPE B, MEAN VALUES OF THE OBSERVATION
Wayne H. Warren, Jr. Jul. 1980 11 p
(NASA-TM-80849; NSSDC/WDC-A-R/S-80-04) Avail: NTIS HC A02/MF A01 CSCL 03A

The Perth 70 catalog contains accurate positions of 24978 stars, plus other useful data such as approximate proper motions, radial velocities, and parallaxes. The Perth 70 is a result of meridian circle observations made by the Hamburg observatory expedition to Perth as part of the international effort of Southern References Stars (SRS). Tape B, which contains mean values of the observations and corresponds to the printed catalog is described. A.R.H.

N80-32305*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASTRONOMICAL DATA CENTER BULLETIN, VOLUME 1, NO. 1
Wayne H. Warren, Jr., ed., Theresa A. Nagy, ed., and Jaylee M. Mead, ed. Jul. 1980 54 p refs
(NASA-TM-80764; NSSDC/WDC-A-R/S-80-07-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 03A

Information about work in progress on astronomical catalogs is presented. In addition to progress reports, an upadated status list for astronomical catalogs available at the Astronomical Data Center is included. Papers from observatories and individuals involved with astronomical data are also presented. L.F.M.

N80-32306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BLACKBODY CURVES FOR THE IUE SPECTRAL RANGE LAMBDA 1150 TO LAMDA 3200 FROM 6,000 TO 200,000 K
W. A. Feibelman Aug. 1980 44 p
(NASA-TM-81997) Avail: NTIS HC A03/MF A01 CSCL 03A

Two sets of blackbody curves are presented for the wavelength region covering the international ultraviolet explorer spectrographs. One set is normalized to unity at 3200 A, the other is normalized at 1900 A for those astronomers primarily interested in data for the SWP range. The blackbody curves extend from 1150 to 3200 A and cover the temperature range from 6,000 to 200,000 K. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-32307# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTATIONAL ASTROPHYSICS RELATING TO THE INTERSTELLAR MEDIUM: PROBLEMS AND PROSPECTS FOR THE 1980'S
Paul R. Woodward May 1980 8 p Presented at the Conf. on Computational Astrophys., Langley AFB, Va. Feb. 1980; sponsored by NASA. Ames Research Center Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84410; CONF-800236-1) Avail: NTIS HC A02/MF A01

The general goal of research on the interstellar medium is to understand the structure and dynamics of the interstellar gas. This subject is important for three reasons. First, the classic tracers of the spiral structure of galaxies are related directly to the gaseous component of galactic disks, therefore, an understanding of the dynamics of the gas is essential in interpreting observations of spiral galaxies. Second, radio continuum observations relate to the magnetic field, which is frozen into the gas under most circumstances. Hence these observations must be interpreted using magnetohydrodynamic models. Third, the initial conditions for star formation are determined by the structure and dynamics of the interstellar gas. In this way gas dynamics plays an essential role in understanding the relative numbers of binary and single stars, the formation of planetary systems, and even the evolution of the stellar content of galaxies. DOE

N80-32308# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL STUDY OF ROTATING INTERSTELLAR CLOUDS: EQUILIBRIUM AND COLLAPSE Ph.D. Thesis
Michael Lester Norman Jun. 1980 231 p refs Submitted for publication
(Contract W-7405-eng-48)
(UCRL-52946) Avail: NTIS HC A11/MF A01

The equilibrium and collapse of rotating, axisymmetric, idealized interstellar gas clouds is calculated with a 2D hydrodynamics code. The hydrodynamics features an improved angular momentum advection algorithm. Angular momentum is advected consistently with mass by deriving angular momentum fluxes from mass fluxes and the local distribution of specific angular momentum. Local conservation is checked by a graph of mass versus specific angular momentum for the cloud as a whole. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-32309*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MINERALOGIC AND PETROLOGIC STUDIES OF LUNAR SAMPLES AND METEORITES Final Report, 1 Feb. 1979 - 31 Aug. 1980
John A. Wood 31 Aug. 1980 17 p refs
(Grant NsG-7596)
(NASA-CR-163498) Avail: NTIS HC A02/MF A01 CSCL 03B

Experimental and thermodynamic research on the pressure temperature limits of the stability of the mineral assemblages found in pristine, spinel bearing lunar highland lithologies demonstrated the likelihood that the minerals originated in the lower stratigraphic levels of the primordial crust. The phase equilibrium in silicate solid/liquid systems of planetary importance were thermochemically interpreted in order to model the early formation of the crusts and maneles of Earth and Moon sized planets. The petrography and chemical composition of coarse grained gabbro, the chemical analysis and age dating of clasts from Apollo 16 breccia, the analysis of glass particles from Apollo 16 soil samples, the study of Allende and Mokoia meteorites as a source of information about events in the solar nebula, and the hydrothermal alteration of amorphous materials were also investigated. The capabilities of a model for addressing the problem of the origin of the Earth's moon by the disruptive capture mechanism are examined as well as models of the thermal evolution of hypothetical meteorite bodies. Progress in determining the composition of stony meteorite specimens collected at the Allan Hills site during the Antarctic field exploration is reported. A.R.H.

N80-32310*# National Aeronautics and Space Administration, Washington, D. C.

THE INTERNATIONAL HALLEY WATCH
Jul. 1980 80 p refs
(NASA-TM-82181) Avail: NTIS HC A05/MF A01 CSCL 03B

In preparation for the 1985 to 1986 apparition of Halley's Comet, the International Halley Watch (IHW) has initiated a comprehensive program to stimulate, encourage, and coordinate scientific observation of the apparition. The observing groups with which the IHW plans to interact are discussed and the ground based observing nets are described in detail. An outline of the history of observations of Halley's Comet and a synopsis of comet properties and physics are included. E.D.K.

N80-32311*# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE MOSAICS OF MARS: AS SEEN BY THE VIKING LANDER CAMERAS Final Report
Elliott C. Levinthal (Stanford Univ.) and Kenneth L. Jones Washington NASA Sep. 1980 79 p
(Grant NsG-7538)
(NASA-CR-3326) Avail: NTIS HC A05/MF A01 CSCL 03B

The mosaics and derivative products produced from many individual high resolution images acquired by the Viking Lander Camera Systems are described: A morning and afternoon mosaic for both cameras at the Lander 1 Chryse Planitia site, and a morning, noon, and afternoon camera pair at Utopia Planitia, the Lander 11 site. The derived products include special geometric projections of the mosaic data sets, polar stereographic (donut), stereoscopic, and orthographic. Contour maps and vertical profiles of the topography were overlaid on the mosaics from which they were derived. Sets of stereo pairs were extracted and enlarged from stereoscopic projections of the mosaics. S.F.

N80-32312# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WHERE ARE THE ASTEROIDS? THE DESIGN OF ASTPT AND ASTID
Laurence G. Taff 15 Apr. 1980 81 p refs
(Contract F19628-80-C-0002; AF Proj. 3221)
(AD-A087422; TN-1980-24; ESD-TR-80-25) Avail: NTIS HC A05/MF A01 CSCL 03/1

The design of software to be used for the planning of minor plant planet observations and the identification of a particular asteroid when it is observed at a given time is discussed. In each case the large number of cataloged asteroids (approximately 2200) has required that the software be optimal with respect to execution speed. This is accomplished by using an approximate geocentric ecliptic position to eliminate, as quickly (in terms of CPU time) as possible, the minor planet from further consideration. In particular, using the type of analysis applicable to near-stationary artificial satellites, and carefully quantifying the nature of the approximations, an approximate geocentric ecliptic latitude and longitude are obtained in such a fashion that the computations needed for these are not only minimal but, should the actual location of the minor planet be needed, maximally used there too. The user's interaction with the software documentation of the calculations, sample outputs, and the rationale of observing asteroids are also discussed. M.G.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-32313# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOLAR MAGNETIC FIELD STUDIES (PHOTON COUNTER) Final Report, Aug. - Sep. 1979
L. Mertz Hanscom AFB, Mass. AFGL Oct. 1979 26 p refs
(Contract F19628-79-C-0183)
(AD-A082242; AFGL-TR-79-0240) Avail: NTIS HC A03/MF A01 CSCL 03/2

Two dimensional photon counters that preserve the temporal ordering of the photons in a form suitable for a new algorithm for speckle imaging are described. Specifications are given for such a device that is under development and attention is given to a commercially available device that is being procured. The calibration and sensitivity of the speckle imaging algorithm are also discussed. A.R.H.

N80-32314*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LONGITUDINAL AND TRANSVERSE MAGNETIC FIELD PROGRAM PROCEDURE AND DETAILED SPECIFICATION FOR SIGMA 5
Caroline K. Wang Aug. 1980 91 p
(NASA-TM-78292) Avail: NTIS HC A05/MF A01 CSCL 03B

A computer program and procedure for plotting the contour of the data transferred from the Marshall Space Flight Center solar magnetography is presented. The plotted data then can be easily compared with solar data from other sources, such as the Solar Maximum Mission. From the data file for circular polarization the longitudinal program plots the contours for filtered longitudinal plot and intensity plot by choosing the positive and negative contour levels, intensity levels, and also X,Y plotting ranges which need to be used. In a similar manner the transverse program generates the transverse contour plot, azimuth plot, and intensity plot from the linear polarization data files. M.G.

N80-32315*# Weber State Coll., Ogden, Utah. Dept. of Physics.
SPECTRUM SYNTHESIS OF EUV SOLAR FLARE LINE PROFILES Final Report
David A. Tripp Jul. 1980 18 p refs
(Contract NAS8-33113)
(NASA-CR-161551) Avail: NTIS HC A02/MF A01 CSCL 03B

A classic double ribbon flare of importance 1B occurred at approximately 1405 UT on June 15, 1973, reached an H alpha maximum at 1413 UT, and ended at 1455 UT. The flare occurred in an old and simplifying bipolar region at N18 W32. This flare was studied due to the extensive temporal data available. A total of 136 spectra of wavelength ranges from 1100 to 3000 A were taken during the flare's duration by the Naval Research Laboratory normal incidence slit spectrograph. Using this data the nature of the solar chromosphere of a flare event as a function of time was determined. E.D.K.

N80-32316*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HELIOS SOLAR PROBES SCIENCE SUMMARIES Progress Report, 1974 - 1979
James H. Trainor, ed. Aug. 1980 106 p refs
(NASA-TM-82005) Avail: NTIS HC A06/MF A01 CSCL 03B

The principal results of the Helios investigations through the first five years of the missions are presented. R.C.T.

N80-32317# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SOLAR ECLIPSE (1979). PART 1: ATMOSPHERIC SCIENCES LABORATORY FIELD PROGRAM SUMMARY
Melvin G. Heaps (New Mexico State Univ., Las Cruces), Robert O. Olsen (New Mexico State Univ., Las Cruces), Warren Berning (New Mexico State Univ., Las Cruces), John Cross, and Authur Gilcrease May 1980 43 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A087318; ERADCOM/ASL-TR-0059) Avail: NTIS HC A03/MF A01 CSCL 04/1

The 26 February 1979 solar eclipse provided a unique opportunity to investigate the properties of the middle atmosphere, including the lower ionospheric D region, during a succinct day-'night'-day transition. The Atmospheric Sciences Laboratory (ASL) assisted in coordinating a multiagency field experiment program which encompassed a wide range of effort. Experiments carried out during the several day period centering on the eclipse were characterized by an unusually high degree of success. Nineteen small sounding rockets and 14 large rockets were launched without a major experimental failure. Ground based measurements provided additional information. Of particular interest to the Army is the investigation of electron attachment/detachment processes in the D region which in turn have a bearing on ELF, VLF, and HF communications, BMD radar systems,

and atmospheric deionization in the post nuclear burst atmosphere. This report is Part 1 of a series and is primarily concerned with providing a summary of the 1979 Solar Eclipse Field Program and sponsored experiments. Part 2 will provide an account of the experimental data acquired by the ASL experiments, and a subsequent Part 3 will detail the atmospheric modeling efforts using the data from the 1979 solar eclipse. GRA

N80-32318# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.
DYNAMICAL PHENOMENA IN SUNSPOTS Final Report, 1 Oct. 1976 - 30 Sep. 1979
John H. Thomas, Alfred Clark, Jr., and Mark A. Scheuer 15 Feb. 1980 83 p refs
(Contract F19628-77-C-0079; AF Proj. 2311)
(AD-A086010; AFGL-TR-80-0064) Avail: NTIS HC A05/MF A01 CSCL 03/2

The reflection of upward and downward propagating Alfven waves in sunspots is studied, in order to assess the possibility of cooling by Alfven waves. Wave reflection is studied by means of a three layer model of the umbral atmosphere. The results show very strong downward reflection of Alfven waves in the photosphere and low temperature, but only weak upward reflection in the convection zone. Further study of more realistic magneto-atmospheric waves (including the effects of compression and buoyancy) shows strong upward reflection in the convection zone as well as strong downward reflection in the photosphere and low chromosphere. These results tend to rule out significant sunspot cooling by waves. A study of a simple thermal model of a sunspot, based on the concept of partial inhibition of convection, shows that the inhibition mechanism can yield acceptable distributions of surface temperature. The results of this model also show that: (1) the edge of the umbra is sharp, even for deep spots; (2) deep spots produce weak bright rings, but shallow spots produce intense bright rings in conflict with observations; and (3) only a shallow surface layer of the sunspot is cool, the rest being warmer than the surroundings. Umbral oscillations in sunspots are studied and identified as a resonant response of the umbral atmosphere to forcing by oscillatory convection in the subphotosphere. The full linearized equations for magneto-atmospheric waves are solved numerically for a detailed model of the umbral atmosphere. It is suggested that the Sun's radius and surface temperature vary with the solar cycle due to the variation of total magnetic buoyancy in the convection zone over the cycle of the solar dynamo. GRA

N80-32319# Watt Engineering Ltd., Cedaredge, Colo.
CIRCUMSOLAR RADIATION
A. D. Watt Apr. 1980 283 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7009) Avail: NTIS HC A13/MF A01

The development of a model which will permit estimation of circumsolar radiation based on solar and meteorological input data is discussed. The results of observations are presented including radiance characteristics and time variations of the circumsolar component at a number of locations. The characteristics of the atmosphere are presented with primary emphasis on large particles. Physical models of circumsolar radiation are developed. The model results are based on: long term average turbidity values, derived average pollen loadings, and actual monthly average sky cover values for the years shown. Regression analysis employed to determine the circumsolar values based on observed solar radiation and atmospheric parameters. The regression derived models show that fairly good agreement can be obtained between observed and calculated monthly average circumsolar ratios by simple expressions employing only the active cavity radiometer values. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-32320*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Space Sciences Dept.
DATA REDUCTION AND ANALYSIS FOR THE TRW IMP-7 PLASMA WAVE EXPERIMENT Final Report
Frederick L. Scarf 31 Oct. 1979 5 p refs
(Contract NAS5-23150)
(NASA-CR-160011; Rept-22751-6011-RU-00) Avail: NTIS HC A02/MF A01 CSCL 03B

Highlights from the IMP 7 plasma wave experiment are briefly outlined. The measurements in the tail revealed great complexities involving substorms and fireballs and provided insight into the overall dynamics of the magnetosphere. The low levels of magnetic turbulence may be of significance with respect to the development of tearing mode dissipation for reconnection events. The IMP wave observations in the distant magnetosphere boundary region showed that the boundaries were quite diffuse and frequently purely defined. Finally, nearly simultaneous IMP 7 and 8 comparisons were used to achieve an understanding of shock structure and propagation. M.G.

N80-32321# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ISOTROPIC MODULATION OF GALACTIC COSMIC RAYS
Nunzio Iucci (Rome Univ.) Oct. 1979 16 p refs Presented at 16th. Intern. Cosmic Ray Conf., Kyoto, Aug. 1979
(LPS-79-12) Avail: NTIS HC A02/MF A01

Phenomena associated with cosmic ray isotropic modulation are reviewed. Both short-term and long-term variations are considered. For the most part, neutrino monitor data is cited. Results are used to explain solar activity cycle-related modulation fluctuations. The effects of Forbush decreases as well as cosmic ray modulation produced by coronal holes are touched on. Possible modulation as a result of 27 day recurrences is postulated. Finally, the power spectra of cosmic ray intensity fluctuations are analyzed using a maximum entropy method. Author (ESA)

99 GENERAL

N80-32322# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
INDIRECTLY FUNDED RESEARCH AND EXPLORATORY DEVELOPMENT AT THE APPLIED PHYSICS LABORATORY, FISCAL YEAR 1978 Annual Report, 1 Jan. - 31 Dec. 1978
R. W. Hart, ed. Dec. 1979 169 p refs
(Contract N00024-78-C-5384)
(AD-A086948; JHU/APL/SR-79-2) Avail: NTIS HC A08/MF A01 CSCL 05/2

The report is organized in two parts. The first part summarizes the IR D work of the Research Center, which is the Division of the Laboratory devoted primarily to long term scientific research. The second part summarizes the IR D activities carried out in other, generally more applications oriented, groups of the Laboratory. GRA

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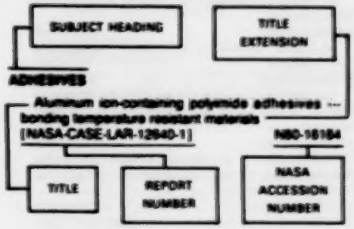

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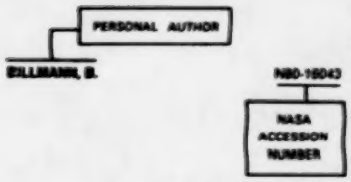

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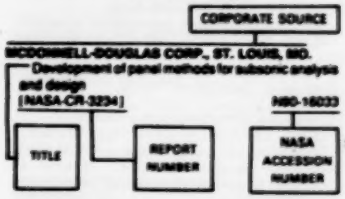

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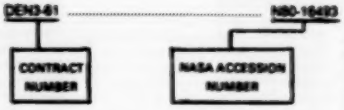

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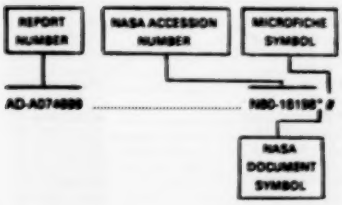

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CONF-800804-1 ..... N80-31840 #
CONF-800805-1 ..... N80-31926 #
CONF-800805-6 ..... N80-31924 #
CONF-800806-2 ..... N80-31643 #
CONF-7809211-1 ..... N80-31947 #
CONF-7905143 ..... N80-31435 #
CONF-7909138-1 ..... N80-31861 #
CONF-7910158-1 ..... N80-31976 #

CONS-5089-8 ..... N80-31541 #

CONTRIB-215 ..... N80-31867 #

COO-1340-66 ..... N80-32034* #
COO-2195-36 ..... N80-32035 #
COO-2792-3 ..... N80-32085 #
COO-2858-24 ..... N80-31941 #
COO-4027-3 ..... N80-31487 #
COO-4094-66 ..... N80-31913 #
COO-4238-14 ..... N80-31945 #
COO-4441-3 ..... N80-31488 #
COO-4938-3 ..... N80-31486 #
COO-4993-2 ..... N80-31542 #
COO-5085-4 ..... N80-31915 #

CORADCOM-78-2922-2 ..... N80-32217 #

CPIA-PUBL-308-VOL-1 ..... N80-31565
CPIA-PUBL-308-VOL-2 ..... N80-31588

CRC-APRAC-CAPA-8-71 ..... N80-31987 #
CRC-APRAC-CAPA-12-72-DB ..... N80-31992 #
CRC-APRAC-CAPA-15-76B-VOL-2 ..... N80-32017 #

CRC-APRAC-CAPM-31-79 ..... N80-32088 #

CRPE-NT-76 ..... N80-31710 #
CRPE-NT-77 ..... N80-31740 #

CSIR-S-238 ..... N80-32150 #

D-254 ..... N80-31857* #

DAI-TR-235-VOL-2 ..... N80-32112 #

DCA/MSO-TR-80-1 ..... N80-31430 #

DCEC-EP-5-79 ..... N80-31695 #

DCEC-TN-2-80 ..... N80-31696 #

DCIEM-TC-80-C-02 ..... N80-32105 #

DDC/TR-79/1-SUPPL-2 ..... N80-32276 #

DELET-TR-77-2841-5 ..... N80-31784 #
DELET-TR-78-0558-1F ..... N80-31893 #

DELNV-TR-0011 ..... N80-31894 #

DFVLR-FB-80-03 ..... N80-31865 #

DG-501-70-VOL-1 ..... N80-32274 #
DG-501-79-VOL-1 ..... N80-32274 #

DGS-296 ..... N80-31853 #

DHC-DND-80-1 ..... N80-31350* #

DHEW/PUB/FDA-80-8109 ..... N80-32087 #

DNA-5077F ..... N80-31972 #

DOE-METC/5199/7 ..... N80-31854 #

DOE/BETC-PPS-80/2 ..... N80-31627 #

DOE/CS-0016/T2 ..... N80-31537 #
DOE/CS-0161 ..... N80-31946 #
DOE/CS-30242/2 ..... N80-31955 #
DOE/CS-34196/T1 ..... N80-31921 #

DOE/ER-0051 ..... N80-31951* #
DOE/ER-03118/13 ..... N80-31505 #
DOE/ER-04072/3 ..... N80-31543 #
DOE/ER-04222/3 ..... N80-31500 #
DOE/ER-04971/2 ..... N80-32194 #
DOE/ER-05002/7 ..... N80-32261 #
DOE/ER-10413/1 ..... N80-31508 #
DOE/ER-10443/1 ..... N80-32183 #
DOE/ER-10444/1 ..... N80-31739 #
DOE/ER-14953/T1 ..... N80-31516 #
DOE/ER-70004/260 ..... N80-32195 #

DOE/ET-10660/1 ..... N80-31499 #
DOE/ET-11266/3 ..... N80-32272 #
DOE/ET-12431/T1-VOL-1 ..... N80-31922 #
DOE/ET-14851/2 ..... N80-31659 #
DOE/ET-15440/1 ..... N80-31938 #
DOE/ET-20460/4 ..... N80-31909 #
DOE/ET-20567/1-2-BK-1 ..... N80-31896 #
DOE/ET-20567/1-2-BK-2 ..... N80-31897 #
DOE/ET-23005/T4 ..... N80-31910 #
DOE/ET-23013/T4 ..... N80-31907 #

DOE/ET/14896-T1 ..... N80-31649 #
DOE/ET/20567-1/1 ..... N80-31948 #
DOE/ET/53038-16 ..... N80-32237 #

DOE/FE-13547/01 ..... N80-31510 #

DOE/JPL-954902 ..... N80-31871* #

DOE/MC-08089/T4 ..... N80-31645 #
DOE/MC-08484/T1 ..... N80-31633 #

DOE/NASA/0027-80/1 ..... N80-31552* #
DOE/NASA/0030-80/3-VOL-3 ..... N80-31869* #
DOE/NASA/0031-80/3-VOL-3 ..... N80-31870* #
DOE/NASA/0116-80/1 ..... N80-32299* #
DOE/NASA/0124-2 ..... N80-31795* #
DOE/NASA/0124-3 ..... N80-31796* #
DOE/NASA/0161-4 ..... N80-31882* #

DOE/PC-10346/1 ..... N80-31503 #

DOE/PETC-TR-80/5 ..... N80-31658 #

DOE/RS-10122/1 ..... N80-31931 #

DOE/TIC-11114 ..... N80-31940 #

DOT-HS-804-828 ..... N80-31812 #

DOT-RSPA-DPB-50-79-25 ..... N80-31993 #

DOT-SPA-DPB-50-79-16 ..... N80-31523 #

DOT-TSC-NHTSA-79-30 ..... N80-31912 #

DOT-TSC-UMTA-79-19 ..... N80-32202 #

DOT/RSPA/DPB-50-80-7 ..... N80-31968 #

DP-MS-80-2 ..... N80-32201 #

DREA-TM-80/B ..... N80-31356 #

DRIC-T-5866 ..... N80-31545 #
DRIC-T-6106 ..... N80-31742 #

DRSMI-E-79-29 ..... N80-31733 #

DRSMI-RL-80-19 ..... N80-31799 #

DSE-3992-T1 ..... N80-31847 #
DSE-4042-T37 ..... N80-31908 #
DSE-4042-T38 ..... N80-31906 #
DSE-4042-T40 ..... N80-31904 #

DTIC/TR-80/5-SUPPL-3 ..... N80-32276 #

DTICH-4185.8 ..... N80-32277 #

DTNSRDC-AERO-1267 ..... N80-31388 #

DTNSRDC-80/078 ..... N80-31389 #
DTNSRDC-80/093 ..... N80-31829 #

DTNSRDC/CMLD-80/11 ..... N80-32152 #

D180-25724-1 ..... N80-31535 #
D180-25724-2 ..... N80-31530 #
D180-25724-3 ..... N80-31531 #

E-452 ..... N80-31401* #
E-506 ..... N80-31402* #
E-510 ..... N80-31449* #
E-519 ..... N80-31399* #
E-539 ..... N80-31400* #
E-554 ..... N80-31797* #
E-555 ..... N80-31798* #
E-562 ..... N80-31527* #

EMD-80-41 ..... N80-31929 #

ENG-PSY-79-4/AFOSR-79-4 ..... N80-32263 #

EPA-450/2-79-007 ..... N80-31998 #
EPA-600/3-79-101 ..... N80-31866 #
EPA-600/3-80-040 ..... N80-31864 #
EPA-600/4-80-020 ..... N80-31522 #
EPA-600/7-79-200 ..... N80-31996 #
EPA-600/7-79-245 ..... N80-31985 #
EPA-600/7-80-046A-VOL-1 ..... N80-31890 #

EPRI-AP-1317 ..... N80-31950 #
EPRI-AP-1351 ..... N80-32233 #

EPRI-EM-1286 ..... N80-31937 #
EPRI-EM-1341 ..... N80-31961 #

EPRI-NP-1322 ..... N80-31766 #

ER-76300-5 ..... N80-31442* #

ERADCOM/ASL-CR-80-8003-1 ..... N80-32214 #

ERADCOM/ASL-TR-0057 ..... N80-32009 #
ERADCOM/ASL-TR-0059 ..... N80-32317 #

ERC-LIB-8060 ..... N80-31795* #
ERC-LIB-80121 ..... N80-31796* #

ERIM-138600-2F ..... N80-32052 #

ERL-0112-TM ..... N80-32209 #

ERT/P-5287-500 ..... N80-31902 #

ESA-CR(P)-1306-VOL-1 ..... N80-31803 #
ESA-CR(P)-1313-VOL-3 ..... N80-31726 #
ESA-CR(P)-1342 ..... N80-31804 #
ESA-CR(P)-1343 ..... N80-31865 #
ESA-CR(P)-1347 ..... N80-31424 #

ESA-ESTL-44 N80-31804 #

ESA-TT-574 N80-31425 #

ESD-TR-80-25 N80-32312 #
ESD-TR-80-38 N80-32005 #
ESD-TR-80-115-VOL-2 N80-32112 #
ESD-TR-80-122 N80-32102 #

ESG-79-30-VOL-1 N80-31948 #
ESG-79-30-VOL-2-BK-1 N80-31896 #
ESG-79-30-VOL-2-BK-2 N80-31897 #

ETL-0226 N80-31852 #
ETL-0231 N80-31860 #
ETL-0232 N80-31859 #

EUR-6881/I-EN N80-31894 #
EUR-6748-EN N80-31914 #

FAA-AM-80-6 N80-31373 #

FAA-RD-80-71 N80-31886 #

FAA-RD80-29 N80-31887 #
FAA-RD80-2423 N80-32031 #

FDA/BRH-80/80 N80-32087 #

FE-1514-101 N80-31634 #
FE-1800-45 N80-31641 #
FE-2211-11 N80-31642 #
FE-2315-48 N80-31629 #
FE-2434-33A N80-31630 #
FE-2434-98 N80-31636 #
FE-2446-8 N80-31766 #
FE-2468-59-VOL-3-PT-1/2 N80-31644 #
FE-2666-F-VOL-2 N80-31856 #
FE-2806-5 N80-31637 #
FE-2895-7 N80-32231 #
FE-3044-T7 N80-31635 #
FE-3084 N80-31514 #
FE-3125-12 N80-31638 #
FE-3125-18 N80-31639 #
FE-3242-40 N80-31770 #
FE-14809-1 N80-31502 #
FE-15529-2 N80-32230 #

FFA-TN-AU-810 N80-31362 #

FFA-TN-HU-2134 N80-31843 #
FFA-TN-HU-2184 N80-31844 #

FHWA/IL/PR-085 N80-32124 #

FJSRL-TR-80-0007 N80-32271 #

FOA-C-20342-A2 N80-32242 #

FR-28 N80-31801 #
FR-207-01-R1 N80-31693 #

FRA/ORD-78/298 N80-31772 #
FRA/ORD-79/51 N80-31674 #

FUB-2-1979 N80-31713 #
FUB-5-1979 N80-31714 #
FUB-6-1979 N80-31715 #
FUB-7-1979 N80-31716 #
FUB-9-1979 N80-31717 #
FUB-10-1979 N80-31718 #
FUB-12-1979 N80-32036 #
FUB-13-1979 N80-32219 #
FUB-14-1979 N80-31719 #
FUB-18-1979 N80-31720 #
FUB-19-1979 N80-31721 #
FUB-21-1979 N80-32176 #
FUB-22-1979 N80-31722 #
FUB-23-1979 N80-32037 #
FUB-24-1979 N80-31723 #
FUB-26-1979 N80-31724 #
FUB-54-1978 N80-31712 #

FZM-857-VOL-1 N80-31805 #

GA-A-15673 N80-31539 #
GA-A-15777-REV N80-31651 #
GA-A-15790 N80-31540 #

GDC-ASP-80-013-VOL-2 N80-31423* #

GE80ET0104-VOL-3 N80-31870* #

GIDEP-E164-0880 N80-31434 #

GIT-CACM-SNA-2 N80-31823 #
GIT-CACM-SNA-20 N80-31822 #
GIT-CACM-SNA-23 N80-31824 #
GIT-CACM-SNA-24-PT-1 N80-31835 #
GIT-CACM-SNA-25 N80-31825 #

GL-3133 N80-32053 #

HDL-TM-79-24 N80-32215 #
HDL-TM-80-5 N80-32210 #

HEDL-SA-2068-FP N80-31838 #

HSS-B-058 N80-31999 #

ICAF-1143 N80-31821 #

IHR-005 N80-32124 #

ITRI-M-8043-5 N80-31640 #

IPPJ-470 N80-32225 #
IPPJ-471 N80-32224 #

IR-2 N80-31830 #
IR-3 N80-31701 #
IR-5 N80-31784 #

IRT-8164-004 N80-32192 #

IS-4724 N80-31952 #

ISSN-0-309-02998-8 N80-31991 #
ISSN-0-7988-1889-1 N80-32150 #
ISSN-92-63-10553-7 N80-32042 #
ISSN-92-835-0264-7 N80-32283 #
ISSN-92-835-0265-5 N80-31342 #
ISSN-92-835-0266-3 N80-31329 #
ISSN-92-835-0267-1 N80-32125 #
ISSN-92-835-1361-4 N80-31743 #
ISSN-92-835-1362-2 N80-31354 #
ISSN-92-835-1363-0 N80-31412 #
ISSN-92-835-1365-7 N80-31326 #

ISPO-99 N80-31517 #

ISSN-0025-3367 N80-32048 #
ISSN-0078-3781 N80-31363 #
ISSN-0078-3781 N80-31489 #

ITR-4 N80-31541 #

JBA32-F N80-31993 #

JHU/APL/FP8-T-041 N80-31887 #

JHU/APL/SIR-79U-019 N80-32051* #

JHU/APL/SR-79-2 N80-32322 #

JPL-9950-374 N80-32298* #
JPL-9950-396 N80-31871* #
JPL-954777-80/8 N80-31874* #
JPL-954862-79/8 N80-31873* #
JPL-955263-1 N80-32298* #
JPL-955367-80/1 N80-31877* #

JSC-09331-1-PT-1 N80-31443* #
JSC-09331-2-PT-2 N80-31444* #
JSC-14483 N80-31445* #
JSC-16276 N80-31439* #
JSC-16683-VOL-4 N80-31445* #
JSC-16728 N80-31446* #

K/CSD/TM-35 N80-32278 #

KNMI-V-342 N80-32038 #
KNMI-V-345 N80-32039 #
KNMI-V-346 N80-32040 #
KNMI-V-347 N80-32041 #

KVB-5807-842-VOL-1 N80-31982 #
KVB-5807-842-VOL-2 N80-31983 #

L-13252 N80-32188* #
L-13691 N80-31413* #

L-14022 N80-32145* #

LA-UR-80-125 N80-31705 #
LA-UR-80-791 N80-31978 #
LA-UR-80-926 N80-31974 #
LA-UR-80-1076 N80-31959 #
LA-UR-80-1274 N80-31507 #
LA-UR-80-1400 N80-31643 #
LA-UR-80-1825 N80-31518 #
LA-UR-80-1816 N80-32113 #

LA-YR-80-126 N80-31706 #

LA-8182-M N80-31707 #
LA-8212 N80-31908 #

LBL-9750 N80-31947 #
LBL-9789 N80-31648 #
LBL-9870 N80-31628 #
LBL-10248 N80-31923 #
LBL-10293 N80-31538 #
LBL-10545 N80-31504 #
LBL-10655 N80-31501 #
LBL-10679 N80-31512 #
LBL-10716 N80-31932 #
LBL-10842 N80-31513 #
LBL-10913 N80-32236 #
LBL-10928 N80-31671 #
LBL-10950 N80-32184 #

LC-80-17422 N80-31991 #
LC-80-600039 N80-32044 #
LC-80-600047 N80-32288 #
LC-80-600070 N80-31861 #

LEC-13790 N80-31439* #

LG80ER0137 N80-31820* #
LG80ER0149 N80-31384* #

LIDS-P-1017 N80-32148 #

LIDS-TH-1005 N80-31697 #

LMSC-D626041 N80-32101* #
LMSC-D766555 N80-31736 #
LMSC-D770637 N80-31831 #
LMSC-D770654 N80-31534 #

LPI-CONTRIB-382 N80-32294* #

LPS-79-12 N80-32321 #
LPS-80-6 N80-31725 #
LPS-80-10 N80-31727 #

LR-29326 N80-31375* #

LRSM-TR-79-9 N80-32254 #

M-302 N80-32025* #

MAE-1428 N80-31408* #

METC-8450-T2-VOL-1 N80-31912 #

MHSMP-80-23 N80-31562 #

MIT-80-2 N80-31352* #

MIT/LCS/TM-168 N80-32111 #

MLM-2721 N80-31506 #
MLM-2729(OP) N80-31511 #

MMM-2331-0802 N80-31934 #

MPIS-14/1979 N80-32196 #

MRC-R-532 N80-31972 #

MU/LR-97.091/79-VOL-1 N80-31803 #

M80-10 N80-32102 #

NADC-79141-60 N80-31414 #
NADC-80037-60 N80-31389 #
NADC-80076-60 N80-31554 #

NASA-CASE-ARC-11243-2 N80-31472* #
NASA-CASE-ARC-11321-1 N80-31551* #

NASA-CASE-ARC-11326-1 ..... N80-31490* #

NASA-CASE-GSC-12584-1 ..... N80-32248* #

NASA-CASE-LAR-12474-1 ..... N80-31774* #
NASA-CASE-LAR-12659-1 ..... N80-31731* #

NASA-CASE-LEW-12274-1 ..... N80-31790*

NASA-CASE-NPO-14295-1 ..... N80-32245*
NASA-CASE-NPO-14298-1 ..... N80-32244*

NASA-CP-2144 ..... N80-31449* #

NASA-CR-3280 ..... N80-31375* #
NASA-CR-3309 ..... N80-32025* #
NASA-CR-3318 ..... N80-31890* #
NASA-CR-3321 ..... N80-31891* #
NASA-CR-3326 ..... N80-32311* #
NASA-CR-159111 ..... N80-31447* #
NASA-CR-159227 ..... N80-31382* #
NASA-CR-159228-VOL-2 ..... N80-31383* #
NASA-CR-159254 ..... N80-31384* #
NASA-CR-159302 ..... N80-31820* #
NASA-CR-159317 ..... N80-31479* #
NASA-CR-159329 ..... N80-31353* #
NASA-CR-159335 ..... N80-31480* #
NASA-CR-159761 ..... N80-31869* #
NASA-CR-159767 ..... N80-31870* #
NASA-CR-159785 ..... N80-31552* #
NASA-CR-159845 ..... N80-32296* #
NASA-CR-159876 ..... N80-31386* #
NASA-CR-159881 ..... N80-31795* #
NASA-CR-159882 ..... N80-31796* #
NASA-CR-159888 ..... N80-31882* #
NASA-CR-160010 ..... N80-31732* #
NASA-CR-160011 ..... N80-32320* #
NASA-CR-160013 ..... N80-31776* #
NASA-CR-160014 ..... N80-31886* #
NASA-CR-160015 ..... N80-31887* #
NASA-CR-160016 ..... N80-31888* #
NASA-CR-160017 ..... N80-31889* #
NASA-CR-160020 ..... N80-31685* #
NASA-CR-160021 ..... N80-31438* #
NASA-CR-160765 ..... N80-31440* #
NASA-CR-160766 ..... N80-31441* #
NASA-CR-160775 ..... N80-31439* #
NASA-CR-160779 ..... N80-32101* #
NASA-CR-161492 ..... N80-31872* #
NASA-CR-161529 ..... N80-32098* #
NASA-CR-161531 ..... N80-32100* #
NASA-CR-161532 ..... N80-32099* #
NASA-CR-161538 ..... N80-31878* #
NASA-CR-161539 ..... N80-31883* #
NASA-CR-161546 ..... N80-31880* #
NASA-CR-161551 ..... N80-32315* #
NASA-CR-161552 ..... N80-31667* #
NASA-CR-161554 ..... N80-31794* #
NASA-CR-161556 ..... N80-31422* #
NASA-CR-161565 ..... N80-31442* #
NASA-CR-161566 ..... N80-31971* #
NASA-CR-161567 ..... N80-32208* #
NASA-CR-162985 ..... N80-32034* #
NASA-CR-163049 ..... N80-31951* #
NASA-CR-163092 ..... N80-31438* #
NASA-CR-163094 ..... N80-31381* #
NASA-CR-163122-VOL-4-PT-1 ..... N80-31969* #
NASA-CR-163122-VOL-4-PT-2 ..... N80-31970* #
NASA-CR-163394 ..... N80-31871* #
NASA-CR-163448 ..... N80-31964* #
NASA-CR-163449 ..... N80-31526* #
NASA-CR-163450 ..... N80-32148* #
NASA-CR-163451 ..... N80-31408* #
NASA-CR-163454 ..... N80-32051* #
NASA-CR-163498 ..... N80-32309* #
NASA-CR-163513 ..... N80-31875* #
NASA-CR-163514 ..... N80-31874* #
NASA-CR-163515 ..... N80-31873* #
NASA-CR-163516 ..... N80-32050* #
NASA-CR-163517 ..... N80-31625* #
NASA-CR-163518 ..... N80-31877* #
NASA-CR-163519 ..... N80-31994* #
NASA-CR-163520 ..... N80-32298* #
NASA-CR-163522 ..... N80-31876* #
NASA-CR-163523 ..... N80-31624* #
NASA-CR-163525 ..... N80-31759* #
NASA-CR-163526 ..... N80-31352* #
NASA-CR-163535 ..... N80-31963* #
NASA-CR-163537 ..... N80-31760* #
NASA-CR-163538 ..... N80-31884* #

NASA-CR-163547 ..... N80-32007* #
NASA-CR-163548 ..... N80-32008* #
NASA-CR-163578 ..... N80-31250* #
NASA-CR-165125 ..... N80-31777* #
NASA-CR-165131 ..... N80-32223* #
NASA-CR-165133 ..... N80-32186* #
NASA-CR-165137 ..... N80-31251* #
NASA-CR-165150 ..... N80-31422* #

NASA-SP-7011(209) N80-32062*
NASA-SP-7041(20) N80-31855*

NASA-TM-75822 ..... N80-31861* #
NASA-TM-75829 ..... N80-31385* #
NASA-TM-76131 ..... N80-32247* #
NASA-TM-76149 ..... N80-32055* #
NASA-TM-76154 ..... N80-32064* #
NASA-TM-76160 ..... N80-32056* #
NASA-TM-76161 ..... N80-32057* #
NASA-TM-76162 ..... N80-32058* #
NASA-TM-76189 ..... N80-32065* #
NASA-TM-76193 ..... N80-32059* #
NASA-TM-76208 ..... N80-31856* #
NASA-TM-76234 ..... N80-31857* #
NASA-TM-76235 ..... N80-31421* #
NASA-TM-76305 ..... N80-32066* #
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NASA-TM-76308 ..... N80-32068* #
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NASA-TM-76321 ..... N80-32070* #
NASA-TM-76333 ..... N80-32071* #
NASA-TM-76335 ..... N80-32072* #
NASA-TM-76337 ..... N80-32073* #
NASA-TM-76338 ..... N80-32074* #
NASA-TM-76347 ..... N80-32075* #
NASA-TM-76349 ..... N80-32076* #
NASA-TM-76350 ..... N80-32077* #
NASA-TM-76352 ..... N80-32060* #
NASA-TM-76354 ..... N80-32078* #
NASA-TM-76355 ..... N80-32079* #
NASA-TM-76356 ..... N80-32080* #
NASA-TM-78284 ..... N80-32270* #
NASA-TM-78292 ..... N80-32314* #
NASA-TM-78293 ..... N80-31879* #
NASA-TM-78294 ..... N80-31418* #
NASA-TM-78297 ..... N80-31419* #
NASA-TM-78299 ..... N80-32187* #
NASA-TM-80215 ..... N80-31481* #
NASA-TM-80220 ..... N80-31482* #
NASA-TM-80268-SECT-1 ..... N80-32190* #
NASA-TM-80268-SECT-2 ..... N80-32191* #
NASA-TM-80712 ..... N80-31858* #
NASA-TM-80734 ..... N80-31426* #
NASA-TM-80764 ..... N80-32305* #
NASA-TM-80849 ..... N80-32304* #
NASA-TM-80905 ..... N80-31420* #
NASA-TM-81112 ..... N80-31995* #
NASA-TM-81113 ..... N80-31996* #
NASA-TM-81119 ..... N80-32303* #
NASA-TM-81120 ..... N80-32273* #
NASA-TM-81137 ..... N80-31443* #
NASA-TM-81138 ..... N80-31444* #
NASA-TM-81172 ..... N80-31397* #
NASA-TM-81190 ..... N80-31407* #
NASA-TM-81224 ..... N80-31775* #
NASA-TM-81227 ..... N80-31473* #
NASA-TM-81228 ..... N80-31386* #
NASA-TM-81558 ..... N80-31399* #
NASA-TM-81561 ..... N80-31401* #
NASA-TM-81571 ..... N80-31400* #
NASA-TM-81577 ..... N80-31402* #
NASA-TM-81581 ..... N80-31797* #
NASA-TM-81582 ..... N80-31798* #
NASA-TM-81585 ..... N80-31527* #
NASA-TM-81867 ..... N80-32023* #
NASA-TM-81870 ..... N80-31684* #
NASA-TM-81874 ..... N80-32145* #
NASA-TM-81997 ..... N80-32306* #
NASA-TM-82001 ..... N80-31778* #
NASA-TM-82005 ..... N80-32316* #
NASA-TM-82181 ..... N80-32310* #
NASA-TM-82183 ..... N80-31445* #
NASA-TM-82184 ..... N80-31446* #
NASA-TM-82272 ..... N80-31387* #

NASA-TP-1695 ..... N80-31413* #
NASA-TP-1697 ..... N80-32188* #

NATICK/TR-80/015 ..... N80-31553 #

NAVTRAEQUIPC-77-D-0028-1 ..... N80-31325 #

NBS-BSS-124 ..... N80-32044 #

NBS-SP-400-60 ..... N80-32298 #

NBSIR-79-1623 ..... N80-31851 #
NBSIR-80-1626 ..... N80-31789 #
NBSIR-80-2002 ..... N80-31773 #
NBSIR-80-2022 ..... N80-31675 #
NBSIR-80-2052 ..... N80-31673 #
NBSIR-80-2057 ..... N80-32289 #

NEAR-TR-206 ..... N80-31355 #

NLR-MP-79004-U ..... N80-31872 #
NLR-MP-79005-U ..... N80-31845 #
NLR-MP-79007-U ..... N80-31846 #
NLR-MP-79008-U ..... N80-31807 #
NLR-MP-79009-U ..... N80-32097 #
NLR-MP-79010-U ..... N80-31842 #
NLR-MP-79019-U ..... N80-31847 #
NLR-MP-79021-U ..... N80-31392 #
NLR-MP-79025-U ..... N80-31848 #
NLR-MP-79027-U ..... N80-31391 #
NLR-MP-79028-U ..... N80-31404 #
NLR-MP-79036-U ..... N80-31361 #

NLR-TR-78035-U ..... N80-31380 #
NLR-TR-78091-U ..... N80-31393 #
NLR-TR-78143-U ..... N80-31548 #
NLR-TR-78146-U ..... N80-31437 #
NLR-TR-78006-U ..... N80-31841 #
NLR-TR-79023-U ..... N80-31389 #

NMAB-358 ..... N80-31528* #

NOAA-TM-ERL-WPL-50 ..... N80-32047 #

NOAA-TR-NOS-83 ..... N80-32020 #

NOAA-TR-NWS-25 ..... N80-32048 #

NOAA-80041102 ..... N80-31549 #
NOAA-80041106 ..... N80-32022 #
NOAA-80043001 ..... N80-32020 #
NOAA-80050102 ..... N80-32048 #
NOAA-80050103 ..... N80-32052 #
NOAA-80050104 ..... N80-32051* #
NOAA-80050202 ..... N80-32021 #
NOAA-80050801 ..... N80-32046 #
NOAA-80050702 ..... N80-32049 #
NOAA-80050709 ..... N80-31989 #
NOAA-80050711 ..... N80-32047 #
NOAA-80050712 ..... N80-32016 #
NOAA-80050713 ..... N80-32054 #

NOR-80-82 ..... N80-31439* #
NOR-80-128 ..... N80-31381* #

NOSC/TR-543 ..... N80-31680 #
NOSC/TR-552 ..... N80-32180 #

NPL-MP-79030-U ..... N80-31390 #

NPS55-79-024 ..... N80-32153 #
NPS55-80-019 ..... N80-32154 #
NPS61-80-003 ..... N80-32033 #
NPS61-80-018 ..... N80-31997 #

NRC-MR-4246 ..... N80-32003 #

NREC-1296-1 ..... N80-31867* #

NRL-MR-4082 ..... N80-31692 #
NRL-MR-4203 ..... N80-32002 #
NRL-MR-4256 ..... N80-32199 #
NRL-MR-4260 ..... N80-32212 #

NRBOH-18 ..... N80-31765 #

NSF/IDOE-CUEA-DR-85 ..... N80-32053 #

NSF/IDOE-80-11 ..... N80-32053 #

NSF/RA-800035 ..... N80-31676 #

NSSDC/WDC-A-R/S-80-01 ..... N80-32303* #
NSSDC/WDC-A-R/S-80-02 ..... N80-32273* #
NSSDC/WDC-A-R/S-80-04 ..... N80-32304* #

NSSDC/WDC-A-R/S-80-06 ..... N80-31425* #
NSSDC/WDC-A-R/S-80-07-VOL-1 ..... N80-32305* #

NSWC/WOL/TR-78-195 ..... N80-31559 #

NTIS/PS-77/0257 ..... N80-32264 #
NTIS/PS-77/0404 ..... N80-31810 #
NTIS/PS-78/0362 ..... N80-32263 #
NTIS/PS-78/0362 ..... N80-32264 #
NTIS/PS-78/0363 ..... N80-32267 #
NTIS/PS-78/0416 ..... N80-31965 #
NTIS/PS-78/0489 ..... N80-31660 #
NTIS/PS-78/0586 ..... N80-31809 #
NTIS/PS-78/0588 ..... N80-31810 #
NTIS/PS-78/0589 ..... N80-31811 #
NTIS/PS-78/0581 ..... N80-31729 #
NTIS/PS-78/0617 ..... N80-32266 #
NTIS/PS-78/0631 ..... N80-31961 #
NTIS/PS-78/0639 ..... N80-31850 #
NTIS/PS-78/0643 ..... N80-32123 #
NTIS/PS-78/0671 ..... N80-32260 #
NTIS/PS-78/0672 ..... N80-32261 #
NTIS/PS-78/0672 ..... N80-32262 #
NTIS/PS-78/0675 ..... N80-31475 #
NTIS/PS-79/0534 ..... N80-31965 #
NTIS/PS-79/0545 ..... N80-31660 #
NTIS/PS-79/0598 ..... N80-32265 #
NTIS/PS-79/0599 ..... N80-32263 #
NTIS/PS-79/0600 ..... N80-32267 #
NTIS/PS-79/0603 ..... N80-31729 #
NTIS/PS-79/0623 ..... N80-32266 #
NTIS/PS-79/0635 ..... N80-31809 #
NTIS/PS-79/0637 ..... N80-31811 #
NTIS/PS-79/0671 ..... N80-32123 #
NTIS/PS-79/0690 ..... N80-31961 #
NTIS/PS-79/0697 ..... N80-31475 #
NTIS/PS-79/0706 ..... N80-31850 #
NTIS/PS-79/0710 ..... N80-32260 #
NTIS/PS-79/0711 ..... N80-32261 #
NTIS/PS-79/0711 ..... N80-32262 #

OEG-PP-267 ..... N80-32180 #

ONERA-NT-1979-11 ..... N80-31469 #
ONERA-NT-1980-1 ..... N80-31363 #

ONERA-P-1980-1 ..... N80-31849 #

ONR-CR-215-237-3F ..... N80-31411 #
ONR-CR-215-263-1 ..... N80-31355 #

ONR-TR-19 ..... N80-32169 #

ONWI-24 ..... N80-32203 #

OR-3 ..... N80-31882* #

ORAU/IEA-80-4-M ..... N80-31939 #

ORC-80-9 ..... N80-32173 #

ORNL-5630 ..... N80-31902 #

ORNL/TM-5738 ..... N80-31515 #
ORNL/TM-7255 ..... N80-31639 #
ORNL/TM-7310 ..... N80-32207 #
ORNL/TM-7348 ..... N80-31632 #
ORNL/TM-7362 ..... N80-31517 #

OSU-CISRC-TR-80-4-PT-1 ..... N80-32278 #
OSU-CISRC-TR-80-4-PT-2 ..... N80-32279 #
OSU-CISRC-TR-80-4-PT-3 ..... N80-32279 #

OTA-ISC-116 ..... N80-31661 #

OU-AMNE-80-8 ..... N80-31832 #
OU-AMNE-80-9 ..... N80-31833 #
OU-AMNE-80-14 ..... N80-31836 #

OWRT-A-036-UTAH-1 ..... N80-31967 #

OWRT-B-036-KAN(1) ..... N80-31867 #

PB80-115249 ..... N80-31964* #
PB80-174030 ..... N80-31963* #
PB80-175987 ..... N80-32045 #
PB80-180995 ..... N80-32279 #
PB80-181126 ..... N80-32044 #
PB80-181647 ..... N80-31772 #
PB80-182082 ..... N80-31549 #
PB80-182439 ..... N80-31998 #
PB80-182538 ..... N80-32302 #
PB80-182587 ..... N80-31677 #
PB80-182603 ..... N80-31965 #
PB80-182789 ..... N80-31996 #
PB80-182801 ..... N80-31967 #
PB80-182819 ..... N80-31967 #
PB80-183155 ..... N80-32053 #
PB80-183674 ..... N80-32268 #
PB80-183882 ..... N80-31674 #
PB80-183909 ..... N80-32019 #
PB80-184021 ..... N80-32022 #
PB80-184203 ..... N80-31523 #
PB80-184229 ..... N80-31673 #
PB80-184450 ..... N80-31522 #
PB80-184583 ..... N80-32068 #
PB80-184922 ..... N80-31993 #
PB80-185002 ..... N80-31968 #
PB80-185358 ..... N80-31812 #
PB80-185531 ..... N80-32269 #
PB80-185622 ..... N80-31773 #
PB80-185648 ..... N80-31851 #
PB80-187206 ..... N80-31675 #
PB80-187255 ..... N80-32124 #
PB80-187305 ..... N80-31984 #
PB80-187529 ..... N80-31866 #
PB80-187594 ..... N80-31982 #
PB80-187602 ..... N80-31983 #
PB80-187867 ..... N80-32087 #
PB80-187990 ..... N80-31987 #
PB80-188139 ..... N80-31992 #
PB80-188253 ..... N80-32019 #
PB80-188376 ..... N80-31990 #
PB80-188444 ..... N80-32048 #
PB80-188376 ..... N80-32020 #
PB80-188394 ..... N80-32052 #
PB80-190010 ..... N80-31966 #
PB80-190622 ..... N80-31991 #
PB80-190705 ..... N80-32017 #
PB80-191141 ..... N80-31789 #
PB80-191455 ..... N80-32047 #
PB80-191483 ..... N80-32046 #
PB80-191471 ..... N80-32021 #
PB80-192719 ..... N80-31661 #
PB80-192917 ..... N80-32049 #
PB80-193295 ..... N80-31999 #
PB80-194988 ..... N80-32054 #
PB80-194996 ..... N80-32051* #
PB80-195001 ..... N80-32016 #
PB80-810963 ..... N80-32106 #
PB80-811136 ..... N80-31728 #
PB80-811144 ..... N80-31729 #
PB80-811342 ..... N80-32266 #
PB80-811375 ..... N80-31660 #
PB80-811458 ..... N80-31965 #
PB80-811516 ..... N80-31650 #
PB80-811623 ..... N80-31980 #
PB80-811631 ..... N80-31961 #
PB80-811797 ..... N80-32123 #
PB80-811821 ..... N80-31908 #
PB80-811839 ..... N80-31809 #
PB80-811847 ..... N80-31810 #
PB80-811854 ..... N80-31811 #
PB80-811904 ..... N80-31475 #
PB80-812035 ..... N80-32265 #
PB80-812043 ..... N80-32267 #
PB80-812050 ..... N80-32263 #
PB80-812068 ..... N80-32264 #
PB80-812217 ..... N80-32260 #
PB80-812225 ..... N80-32261 #
PB80-812233 ..... N80-32262 #
PB80-1185028 ..... N80-31676 #

PD-JL-80-220 ..... N80-32001 #

PERME-MEMO-92 ..... N80-31520 #

PHYSICAL-RESEARCH-85 ..... N80-32124 #

PL-80-040 ..... N80-32228 #

PNL-2004-12 ..... N80-32232 #
PNL-3268 ..... N80-32200 #

PR-79-562 ..... N80-31553 #
PR-336 ..... N80-31856* #
PR-345 ..... N80-31421* #

PRRL-79-CR-39 ..... N80-31732* #
PRRL-80-CR-23 ..... N80-31787 #

PUB-80-155 ..... N80-32229 #
PUB-80-178 ..... N80-32227 #
PUB-80-180 ..... N80-32228 #

PUBL-1358-01-3-2238 ..... N80-31885* #

QPR-2 ..... N80-31907 #

QR-14 ..... N80-31836 #

QTPR-1 ..... N80-31938 #
QTPR-2 ..... N80-31904 #
QTPR-3 ..... N80-31906 #
QTPR-4 ..... N80-31447* #
QTPR-5 ..... N80-31640 #
QTPR-9 ..... N80-31936 #
QTPR-10 ..... N80-31836 #
QTPR-11 ..... N80-32234 #
QTPR-14 ..... N80-31831 #

R-358-PT-2 ..... N80-31677 #
R-2595-DOE ..... N80-31885 #

RADC-TR-79-340 ..... N80-31703 #
RADC-TR-80-29 ..... N80-31998 #
RADC-TR-80-85 ..... N80-31701 #
RADC-TR-80-121 ..... N80-31699 #
RADC-TR-80-142-VOL-1 ..... N80-31688 #
RADC-TR-80-142-VOL-2 ..... N80-31689 #
RADC-TR-80-172 ..... N80-31785 #
RADC-TR-80-191 ..... N80-31698 #

RAE-SPACE-572 ..... N80-31436 #
RAE-SPACE-574 ..... N80-31864 #
RAE-SPACE-575 ..... N80-31427 #
RAE-SPACE-576 ..... N80-32015 #

RAE-TM-AERO-1812 ..... N80-32122 #
RAE-TM-AERO-1826 ..... N80-31416 #
RAE-TM-AERO-1828 ..... N80-31388 #
RAE-TM-AERO-1829 ..... N80-31417 #
RAE-TM-AERO-1838 ..... N80-31395 #

RAE-TM-FS-319 ..... N80-32086 #

RAE-TR-78158 ..... N80-31364 #
RAE-TR-78160 ..... N80-31367 #
RAE-TR-77007 ..... N80-31365 #
RAE-TR-77008 ..... N80-31365 #
RAE-TR-77159 ..... N80-31388 #
RAE-TR-79144 ..... N80-31436 #
RAE-TR-80018 ..... N80-31864 #
RAE-TR-80022 ..... N80-31427 #
RAE-TR-80023 ..... N80-32015 #

RAND/N-1479-DOE ..... N80-32024 #
RAND/N-1501-ONR ..... N80-32089 #

REP-3021 ..... N80-31919 #

REPT-1 ..... N80-31695 #
REPT-2 ..... N80-31696 #
REPT-2-3621 ..... N80-31479* #
REPT-2-57404/OR-52451 ..... N80-31324 #
REPT-7WW/TN-80/002 ..... N80-32026 #
REPT-30 ..... N80-32155 #
REPT-78-FM-51-REV-1 ..... N80-31445* #
REPT-79-FM-1 ..... N80-31445* #
REPT-79-556-C0-10 ..... N80-32216 #
REPT-80-FM-34 ..... N80-31445* #
REPT-80-FM-40-VOL-4 ..... N80-31445* #
REPT-80-2 ..... N80-32258 #
REPT-80-3 ..... N80-32171 #
REPT-80-3 ..... N80-32249 #
REPT-80-4 ..... N80-32250 #
REPT-80-5 ..... N80-32259 #
REPT-80-9E8-MARED-R3 ..... N80-31862* #
REPT-80-16763 ..... N80-31409 #
REPT-163 ..... N80-32093 #
REPT-624RL106 ..... N80-31653 #
REPT-0296-FR-2-PT-2 ..... N80-31691 #
REPT-22751-6011-RU-00 ..... N80-32320* #
REPT-0161117-1-F ..... N80-31428* #

RHO-BWI-C-68 ..... N80-32013 #

RHO-BWI-LD-23 ..... N80-32202 #

RHO-BWI-SA-43 ..... N80-31862 #

RHO-CD-132-REV-5 ..... N80-32205 #

RI/RD80-157 ..... N80-31474 #

RISP/TR-79-1 ..... N80-32018 #

RLO-2438-78/1 ..... N80-31900 #
RLO-2438-78/2 ..... N80-31901 #
RLO-2443-77/1 ..... N80-31930 #

RR-80-11 ..... N80-32181 #

RSRE-MEMO-3229 ..... N80-32114 #
RSRE-MEMO-3257 ..... N80-31741 #

R80-914545-16 ..... N80-31351* #
R80-924624-11 ..... N80-31777* #

SAM-TR-80-1 ..... N80-32110 #
SAM-TR-80-5 ..... N80-31371 #
SAM-TR-80-6 ..... N80-32104 #
SAM-TR-80-8 ..... N80-32081 #
SAM-TR-80-9 ..... N80-32095 #
SAM-TR-80-12 ..... N80-32[illegible]0 #
SAM-TR-80-16 ..... N80-32091 #

SAN-0034-239-1-T2 ..... N80-31827 #
SAN-0113-040-T6 ..... N80-31953 #
SAN-0113/40-3 ..... N80-31905 #
SAN-1167-1 ..... N80-31950 #
SAN-1178-T4 ..... N80-32300 #
SAN-1429-56 ..... N80-31931 #
SAN-11276-2 ..... N80-31935 #
SAN-13108-35 ..... N80-31853 #

SAND-78-0984 ..... N80-31958 #
SAND-78-1962 ..... N80-31954 #
SAND-79-1285 ..... N80-32014 #
SAND-79-1383 ..... N80-31956 #
SAND-79-2044C ..... N80-31924 #
SAND-79-2350C ..... N80-32260 #
SAND-79-2354C ..... N80-31767 #
SAND-79-7054 ..... N80-31950 #
SAND-79-8623 ..... N80-32183 #
SAND-80-0179 ..... N80-31957 #
SAND-80-0433 ..... N80-31925 #
SAND-80-0698C ..... N80-32240 #
SAND-80-0879 ..... N80-32262 #
SAND-80-1025 ..... N80-31855 #
SAND-80-7007 ..... N80-32218 #
SAND-80-7008 ..... N80-31942 #
SAND-80-7009 ..... N80-32319 #
SAND-80-7010 ..... N80-31949 #
SAND-80-8218 ..... N80-31918 #

SAR-2 ..... N80-31956 #

SD-TR-80-33 ..... N80-31432 #
SD-TR-80-44 ..... N80-32004 #

SDTR-80-48 ..... N80-32211 #

SER-510035-VOL-1 ..... N80-31382* #
SER-510036 ..... N80-31383* #

SERI/TP-333-591 ..... N80-31926 #

SERI/TR-33-239-VOL-3 ..... N80-31648 #
SERI/TR-34-093 ..... N80-31916 #
SERI/TR-351-358-VOL-1 ..... N80-31898 #
SERI/TR-351-358-VOL-2 ..... N80-31899 #
SERI/TR-353-459 ..... N80-31911 #
SERI/TR-631-336 ..... N80-31917 #

SERIAL-T-418 ..... N80-32162 #

SG-4253-1182 ..... N80-31698 #

SNIAS-801-422-101 ..... N80-32297
SNIAS-801-422-105 ..... N80-31521 #
SNIAS-801-422-107 ..... N80-32301 #
SNIAS-801-430-104 ..... N80-32243 #

SOLAR/0010-80/02 ..... N80-31975 #
SOLAR/1028-79/50 ..... N80-31920 #

SR-1 ..... N80-31378 #
SR-1 ..... N80-31779 #
SR-1 ..... N80-32000 #
SR-2 ..... N80-32007* #

SR-3 ..... N80-32008* #
SR-4 ..... N80-31853 #

SRC-78-TR-27-PT-1 ..... N80-31802 #

SRI/CSL-70 ..... N80-32119 #
SRI/CSL-113 ..... N80-32120 #

SSD-79-0010-2-1 ..... N80-31890* #
SSD-79-0010-4-VOL-4 ..... N80-31891* #

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SU-GL-3090 ..... N80-31795 #
SU-GL-3147 ..... N80-32193 #

SU-JIAA-TR-23 ..... N80-31760* #

SU-SOL-80-6 ..... N80-32151 #
SU-SOL-80-7 ..... N80-32159 #
SU-SOL-80-8 ..... N80-32158 #

SX/115/PL-2 ..... N80-31876* #

TAC-STHC-79-001 ..... N80-31964* #
TAC-STHC-79-002 ..... N80-31963* #

TAE-331 ..... N80-31818 #
TAE-359 ..... N80-32178 #

TARADCOM-12498 ..... N80-31556 #

TASC-TR-612-3 ..... N80-31411 #

TCR-0513 ..... N80-32298* #

TID-4500-R67-UC62 ..... N80-31925 #

TN-1980-20 ..... N80-32005 #
TN-1980-24 ..... N80-32312 #

TR-1 ..... N80-31495 #
TR-4 ..... N80-31533 #
TR-4 ..... N80-31780 #
TR-4 ..... N80-31822 #
TR-4 ..... N80-32084 #
TR-6 ..... N80-31823 #
TR-7 ..... N80-31824 #
TR-8 ..... N80-31834 #
TR-8 ..... N80-31835 #
TR-9 ..... N80-31825 #
TR-13 ..... N80-31828 #
TR-14 ..... N80-31493 #
TR-14 ..... N80-32028 #
TR-15 ..... N80-31492 #
TR-16 ..... N80-31494 #
TR-16 ..... N80-31496 #
TR-51-2-VOL-4-PT-2 ..... N80-31970* #
TR-51-2-VOL-4PT-1 ..... N80-31969* #
TR-79-8 ..... N80-32252 #
TR-79-11 ..... N80-31529 #
TR-80-4 ..... N80-31557 #
TR-80-5 ..... N80-31555 #
TR-80-088 ..... N80-32229 #
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